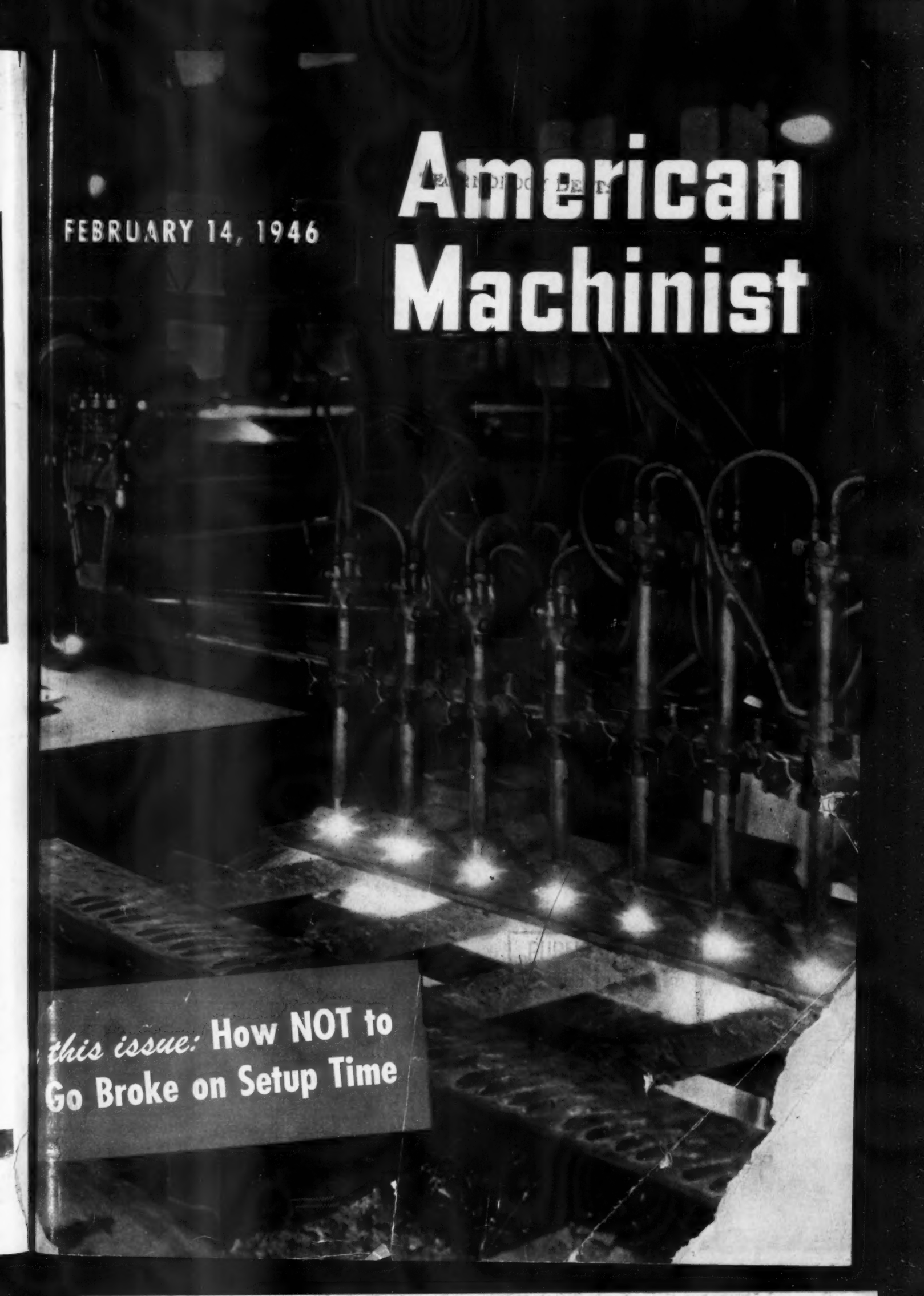
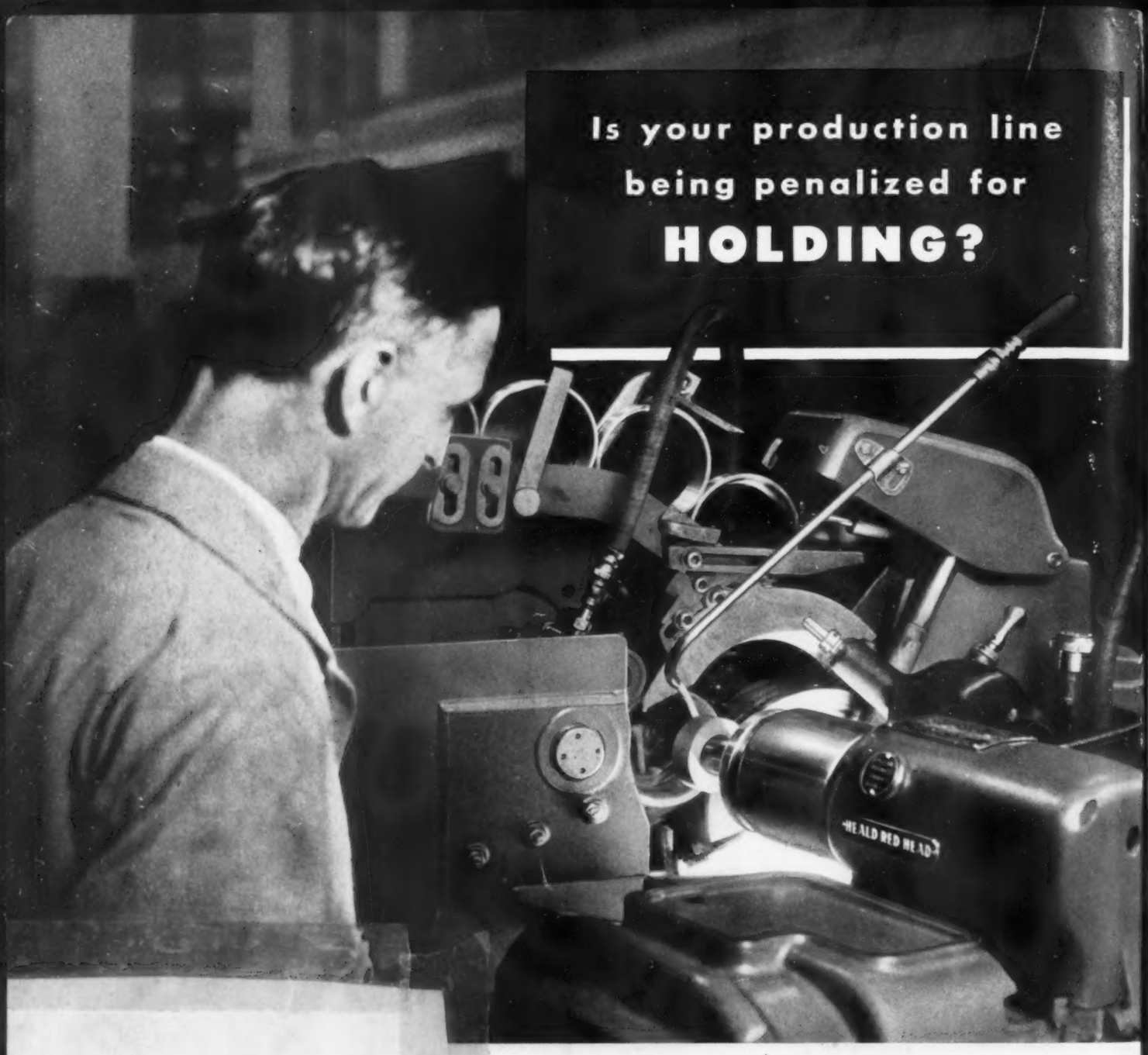


American Machinist

FEBRUARY 14, 1946

this issue: How NOT to Go Broke on Setup Time



EALD CENTERLESS
rinding machine
penalties!

ow consider the advantages of using e Heald Centerless Internal. Instead being loaded in a chuck, the work simply placed between three rolls, hich locate and rotate the part on its wn outside diameter. Simple—but this ethod of grinding improves quality of ork and cuts costs . . . it assures perfect ncentricity between ground bore and .D. . . . permits relocation without ror for rechucking or reversal . . . pro- ces unusual accuracy on thin wall sections . . . and enables one operator to handle several machines.

Available in five different mode ing, a wide range of work, He terless Internals are typical of of engineering which is helping can industry to find new ways o ing production and cutting co further details, write: The Machine Company, Worcester 6

HEALD

means finer precision
. . . lower costs

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American Machinist Chips

Overseas . . . Definite proof that Europe is heading back toward normal is found in the influx of letters from agents there, seeking American machine tool manufacturers to represent. Correspondence is coming from England, France, Belgium and the Netherlands. We have just had one from Barsony Kornel, Pengo ucca 5, Budapest II, Hungary, who explains that "he has been shut out from this line of business by anti-semitic laws since 1938" and that his "few good business connections to America were cut up." Now he's planning "the restoration of the pleasing intercourses which existed between some American houses and me."

Cover Kodachrome . . . Our cover picture in this issue is presented through the courtesy of the By-Products Steel Corporation, Division of Lukens Steel Company, and Air Reduction Sales Company. It shows an 8-torch No. 6A Oxygraph, with magnetic tracer, cutting slots in a steel plate at the By-Products plant. To suit the picture to our cover dimensions, and to take out an operator who insisted upon looking at the camera, one torch is off to the right. You will have to imagine it's there.

Metalworking Models . . . In our January 3 issue we ran an article "Metalworking in Miniature," in which we mentioned in passing that models are available for making plant layouts. Several firms have written us asking for the source of such models and we thought perhaps it was time to make it public. At least two model makers are: John A. Patton, 6349 North Western Ave., Chicago 45, Illinois, and Harold W. Taylor, 101 Park Ave., New York City.

Editor's Night Off . . . Our News Editor, Ben Corrado, apparently got hold of a dictionary the other day and came up with the following: "Believe it or not," says Ben, "here are some phobias that people we know have had right along, but we never knew what they were."

People who sit near the windows generally have Aerophobia (morbid dread of drafts).

The cute little blonde who refuses to go out with us probably has Androphobia (insane dread of the male sex).

People who look down their noses at you generally have Aphephobia (morbid dread of being touched).

The fellow who calls over to you and asks you to walk over to see him has Basiphobia (morbid dread of walking).

We don't think that anybody on *American Machinist* staff has Cenotophobia (morbid dread of new things or ideas).

Nobody on the staff drinks through a straw because they have Crystallophobia (insane dread of glass or glass objects).

The girls who wear the mink never have Doraphobia (insane dread of touching fur).

But some people we know probably have Ergasiophobia (morbid dislike of work).

Our accounting department has Erythrophobia (morbid aversion to red).

None of the staff has Gynephobia (dread of aversion to women), or Hypsophobia (fear of great heights)—we're on the 29th floor here.

Our lay-out staff has Kenophobia (morbid dread of large open spaces). That's why there's no white space at the tail end of articles.

None of our readers have Metallophobia (fear of metals and metallic objects).

But know that some of our salesmen get Onomatophobia (morbid dread of hearing a certain name), when prospects mention competitors.

None of the editors have Scopophobia (morbid dread of being seen), or Siderodromophobia (morbid dread of railroad trips).

The staff gourmets definitely do not have Sitiophobia (dread of taking food).

German Machine Tools . . . The Office of the Publication Board, Department of Commerce, Washington, D. C., recently released a report on the condition of machine tools in the area of Leipzig, Germany. The investigating team consisted of Reed M. Andress of the Barnes Drill Company and Frank Jesche of Micromatic Hone Corporation.

Among the many interesting details of this report is the fact that a majority of the factories were in good condition and well equipped to do a good production job. Generally speaking, there appeared to be no outstanding developments apart from normal improvements.

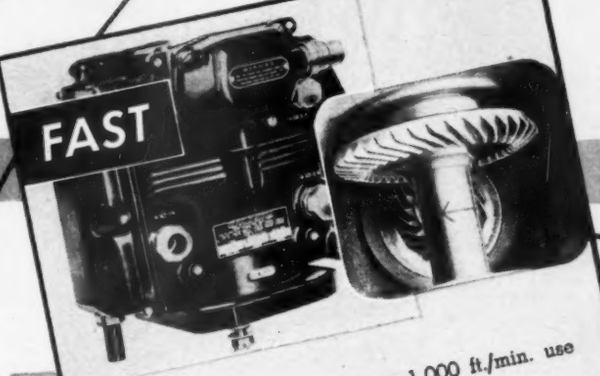
Contributor . . . Our lead article in this issue is by Gregory J. Oberst, pictured below, plant accountant of Elastic Stop Nut Corporation of America. He decided to write "How Not to Go Broke on Setup Costs" because many manufacturers are now faced with the problem of absorbing setup costs for small pieces produced in peacetime quantities.

Oberst brings to his analysis the viewpoints of the engineer and the accountant. He started out as an engineer, but a love of figures (mathematically speaking) and financial problems swung him into the cost accounting field. Before coming to Elastic Stop Nut he was with Chevrolet as plant accountant and before that at Fruehauf Trailer as executive cost accountant and assistant to the comptroller.

FOR ANY SPEED USE BEVEL GEARS

Bevel gears to transmit power and motion can be produced to satisfy any angular drive requirement, maintaining efficiency, durability, smoothness and quietness of operation at fast or slow speeds.

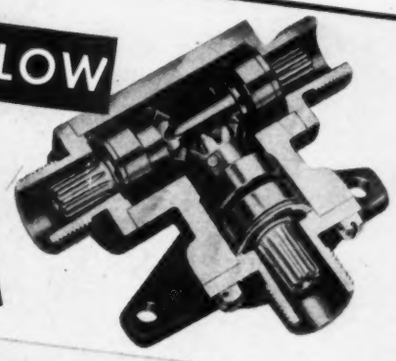
FAST



For pitch line velocities above 1,000 ft./min. use spiral bevel and hypoid gears.

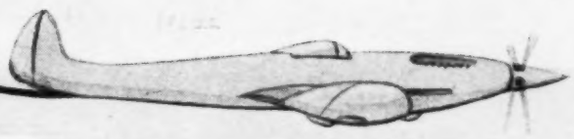
A typical high speed application is the spiral bevels in this aircraft engine magneto. These gears drive the breaker cams which distribute the spark at the rate of 40,000 per minute and operate without fail at the high speeds required through all flight conditions.

SLOW



For pitch line velocities below 1,000 ft./min. use straight and Zerol bevel gears, or spiral bevels or hypoids where extreme smoothness and quietness are required.

The straight bevel gears in this T-drive are used to operate aircraft cowl flaps at slow speed . . . another example of smooth dependable bevel gear power transmission regardless of speed.



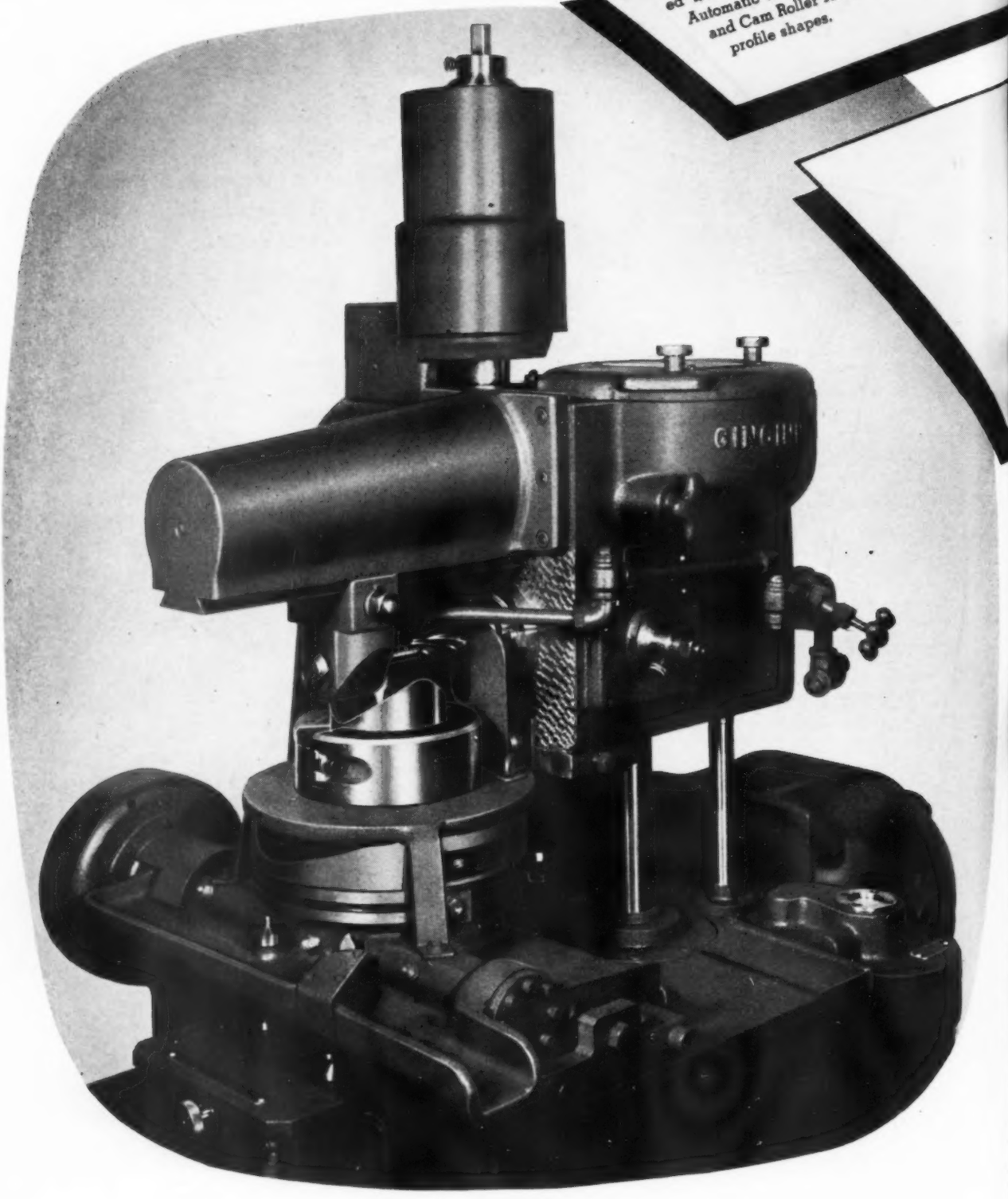
These uses of bevel gears in aircraft are typical of the many fields where bevel gears have proved their capacity to transmit power at any speed. In all cases it is important to select the proper type of bevel gear for the particular application and speed involved. Send us blueprints of your proposed bevel gear design . . . our engineers will study them, suggest improvements and recommend the correct gear cutting machines to meet your specific manufacturing requirements.

GLEASON Works

Builders of BEVEL GEAR MACHINERY FOR OVER EIGHTY YEARS

1000 UNIVERSITY AVENUE
ROCHESTER 3, NEW YORK

Single purpose milling machine, constructed from a basic CINCINNATI No. 0-8 Plain Automatic with Rise and Fall Spindle Carrier and Cam Roller Attachment, for rotary milling profile shapes.



THE CINCINNATI

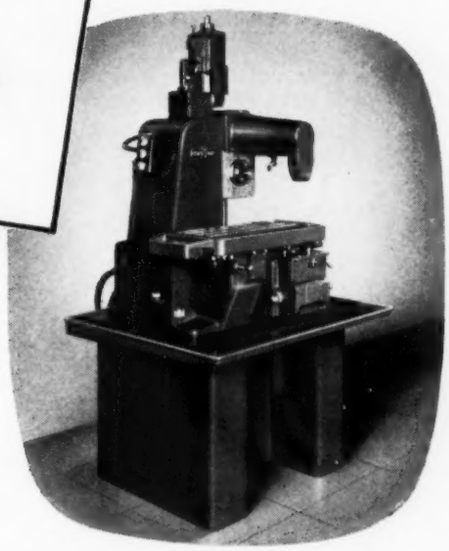
MILLING MACH

Sine Curve Shape Rotary Profile Milled

on a Cincinnati Special 0-8 Miller

CINCINNATI

This equipment was developed to circular mill from the solid, a sine curve shape on one end of two different size parts—a bearing and a sleeve. It consists of a modified CINCINNATI No. 0-8 Plain Automatic Miller with Rise and Fall Spindle Carrier; a built-in circular table; hand-clamping fixture to hold either piece, and a Cam Roller Attachment. A cam roller riding on a cam built into the fixture controls the vertical feed of the spindle carrier. ¶ Rotary profile milling 360° by using a modified CINCINNATI No. 0-8 Miller is a development of Cincinnati Application Engineers, and is indicative of their ingenuity in devising more productive and economical methods of handling out-of-the-ordinary milling operations. They will be glad to study your machining problems. Send blueprint with complete details.



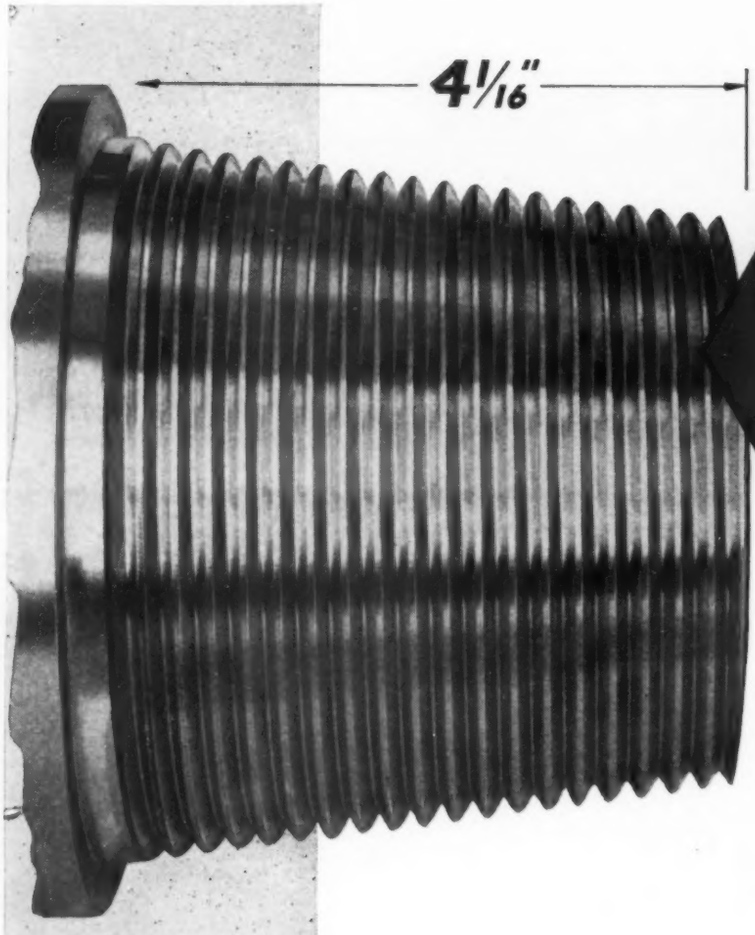
CINCINNATI No. 0-8 Plain Automatic Milling Machine with Rise and Fall Spindle Carrier. Complete specifications may be obtained by writing for Catalog M-964-3. Sweet's Catalog File for Mechanical Industries gives a brief description of this machine.

Development of curve milled on end of bronze bearings and steel sleeves with the equipment illustrated here. The automatic feed cycle consists of: 1) Rapid advance carrier down to work. 2) Feed table clockwise. 3) Rapid retract carrier. 4) Rapid return table counter clockwise to starting position.
Production—bearing, 23 per hour; sleeve, 13 per hour.

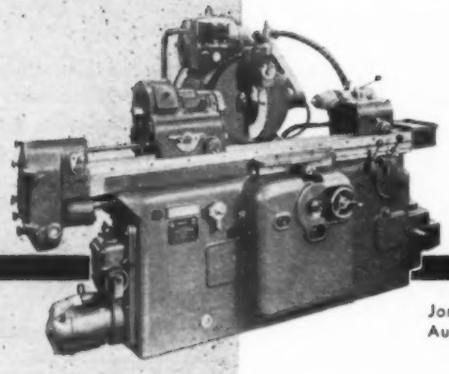
A MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

MACH

BROACHING MACHINES • CUTTER SHARPENING MACHINES



GROUND ONE IN



Jones & Lamson Automatic Thread Grinder

For shorter threads, other multi-rib wheel forms can be used—the full rib type that requires only one complete revolution of the work, and the alternate rib type that requires two complete revolutions. Our engineers can determine the most advantageous method for your needs.

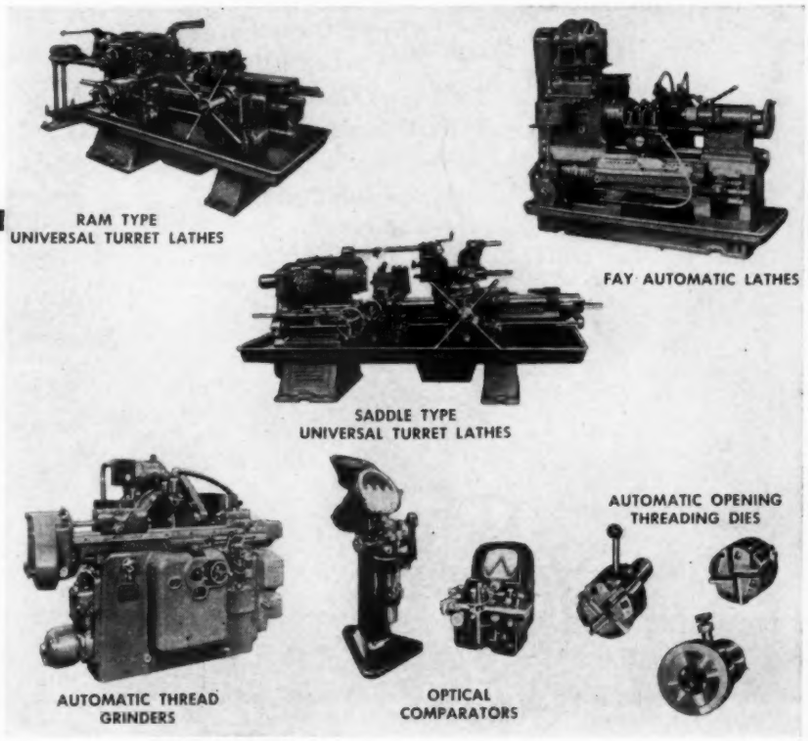
FROM THE SOLID WITH PASS OF THE WHEEL, LESS THAN 4 MINUTES

This is a typical example of multi-rib wheel performance on tough, heat-treated steel forgings with Jones & Lamson Automatic Thread Grinders.

The 5-pitch, special form API thread, with a taper of 3 inches per foot, and a mean outside diameter of 4.117", is ground in less than 4 minutes cutting time with a three-rib wheel, one rib roughing, one semi-finishing and the third finishing. More than one pound of metal is removed.

Rapid metal removal, accuracy of form and quality of finish are assured by the FULLY AUTOMATIC WORK CYCLE of Jones & Lamson Automatic Thread Grinders, which includes AUTOMATIC DIAMOND DRESSING OF THE WHEEL, automatic compensation for amount dressed off the wheel, and automatic sizing.

Why not phone today for one of our engineers to tell you more about production threading with Jones & Lamson Automatic Thread Grinders.

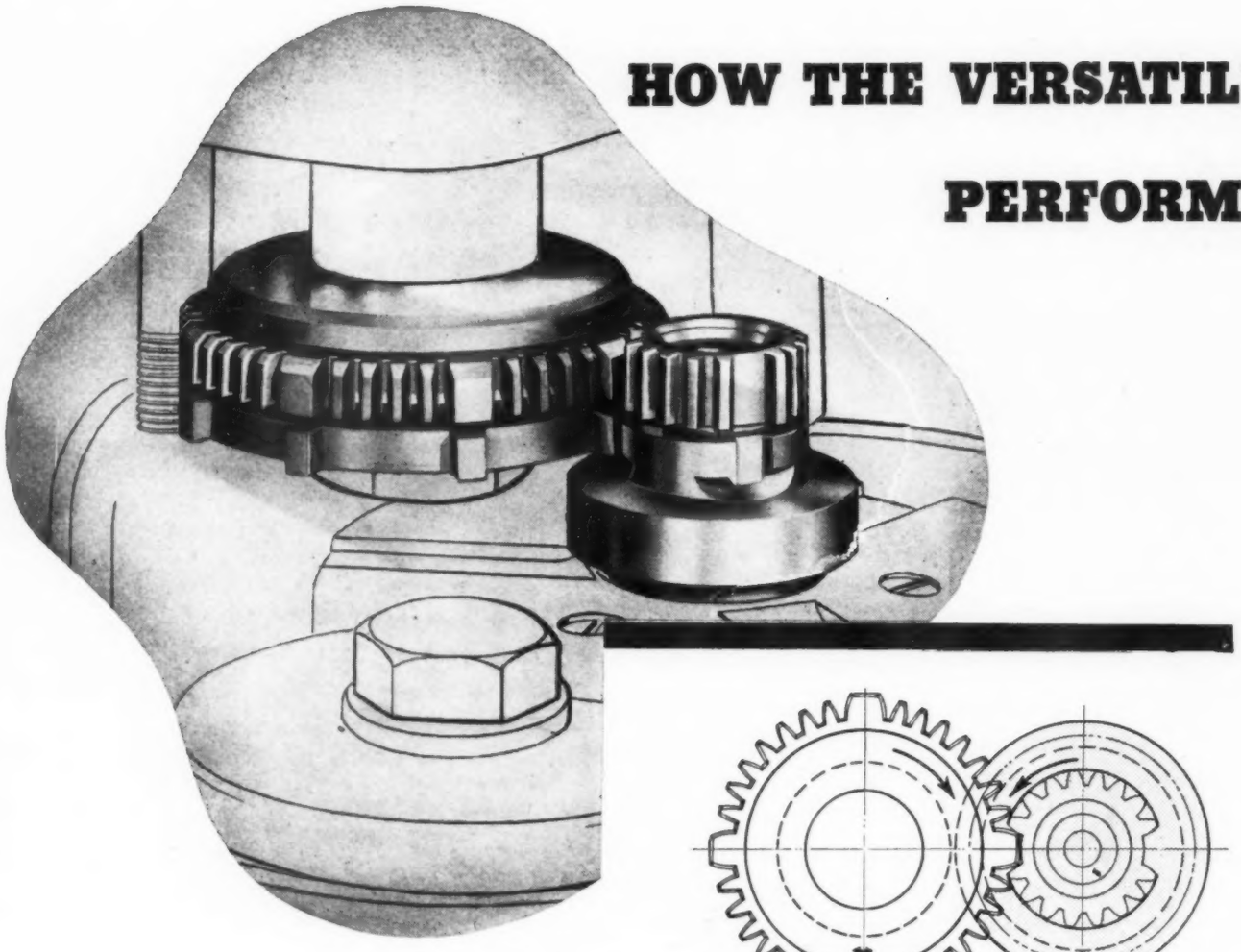


JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

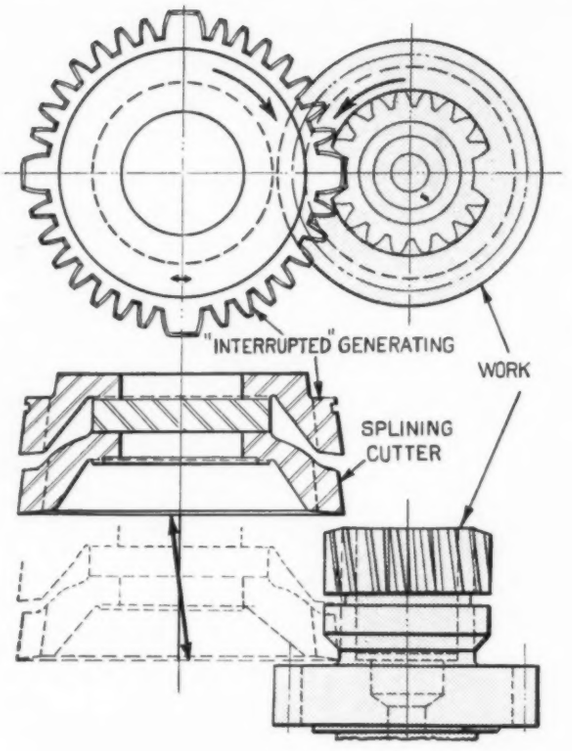
Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

HOW THE VERSATILE

PERFORMS



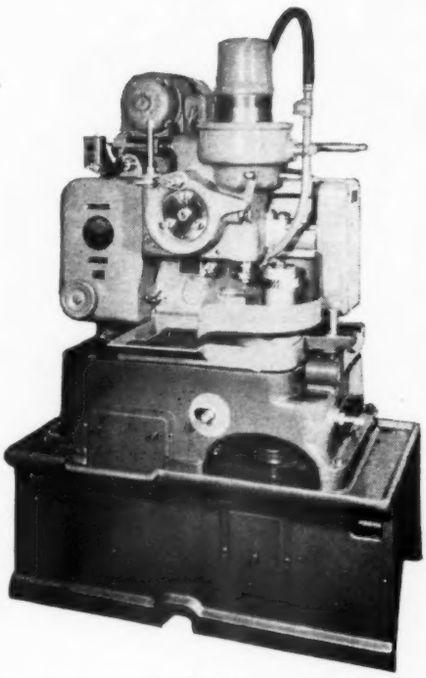
Here Tandem Cutters Perform 2 Operations in 1 Set-up in Cutting Interrupted Gear Teeth and Involute-sided Slots of a Direct-drive Syncromesh Clutch Gear.



THE FELLOWS METHOD...MACHINES AND TOOLS FOR

GEAR SHAPER

2 Operations in 1 Set-up



The versatile, high-speed 7-Type Fellows Gear Shaper.

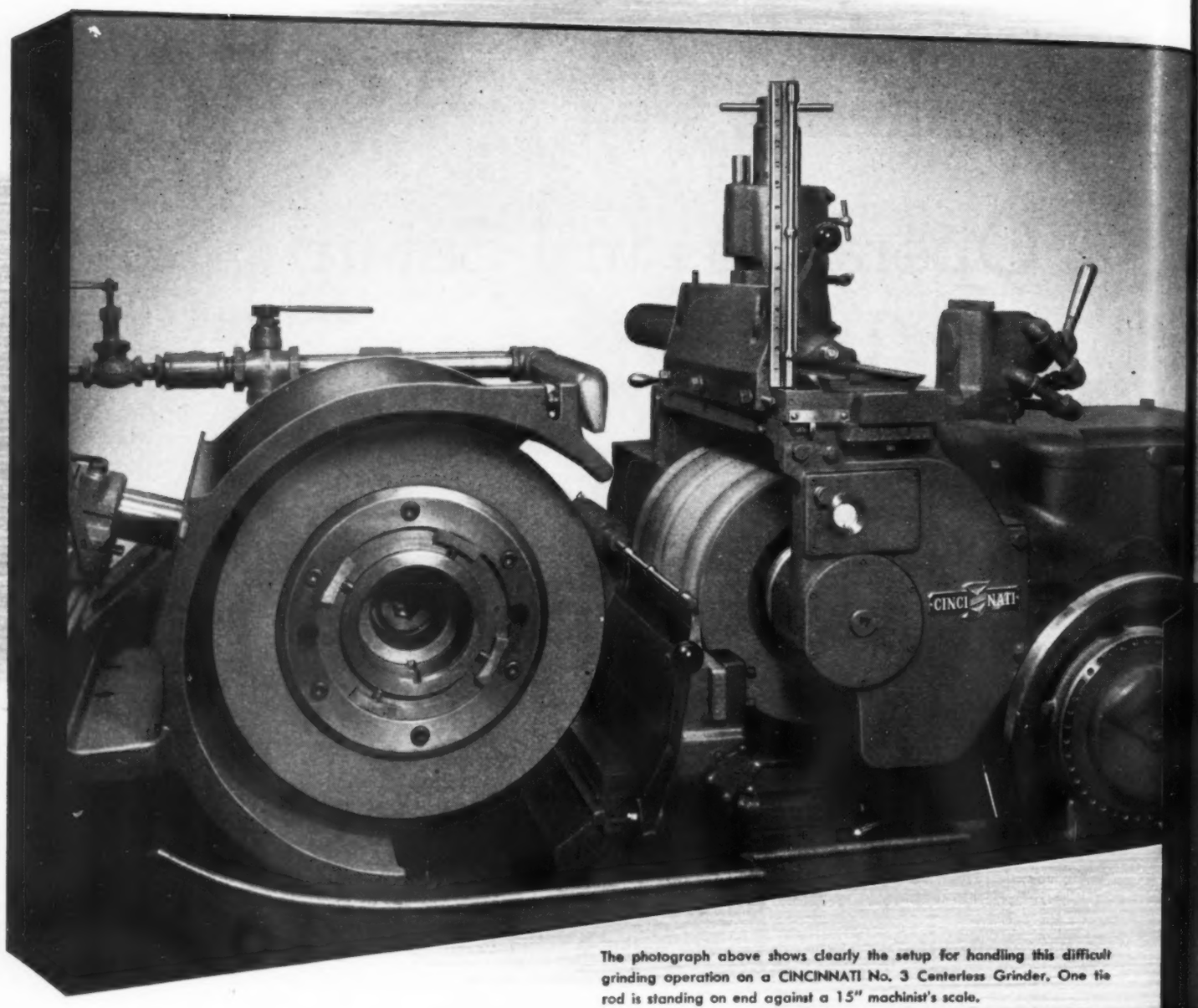
Another outstanding advantage of the Gear Shaper Method is, that in addition to one cutter being capable of producing a variety of shapes on the same piece of work, it is likewise possible to employ two cutters *at one time*, generating different shapes on more than one step of the piece at the same setting.

For example, in machining the Syncromesh Clutch Gear illustrated, the lower cutter generates two helical involute-sided slots for the mechanism while the upper cutter generates the "interrupted" teeth and involute-sided slots for the clutch. Cutters are located on the cutter-spindle by a setting gage, so that a precision relationship between slots and teeth can be maintained. In resharpening, the same amount of material is removed from the cutting faces of both cutters, so that original relative diameters are maintained.

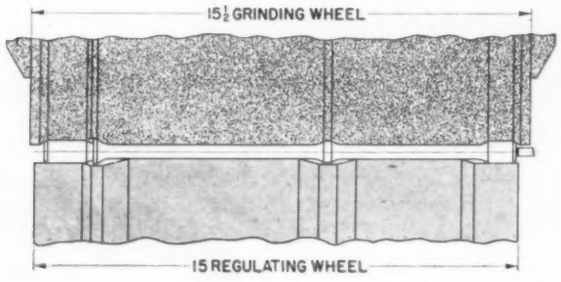
Countless similar parts are likewise machined on the versatile Gear Shaper with savings in time, labor and cost. For complete details, write for your complimentary copy of "The Art of Generating With a Reciprocating Tool." The Fellows Gear Shaper Company, Springfield, Vt., or 616 Fisher Building, Detroit, Mich., or 640 West Town Office Bldg., Chicago, Ill.

Fellows

ALL OPERATIONS FROM BLANK TO FINISHED GEAR



The photograph above shows clearly the setup for handling this difficult grinding operation on a CINCINNATI No. 3 Centerless Grinder. One tie rod is standing on end against a 15" machinist's scale.



Sketch shows the part between the grinding and regulating wheels. All diameters over the entire length of the crankcase tie rod are ground at one time, thus assuring absolute concentricity.

CINCINNATI

CENTER TYPE GRINDING MACHINES

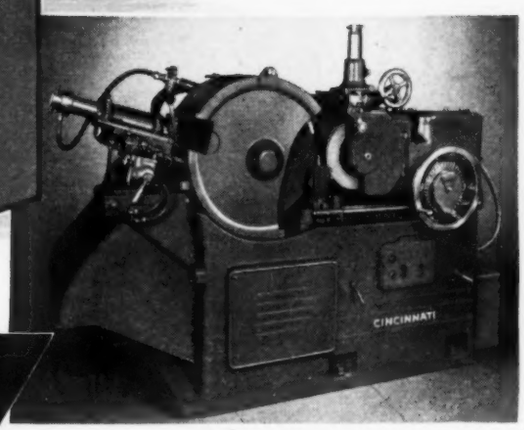
CINCINNATI Centerless Grinders are the logical machines to use for grinding long, slender parts such as the crankcase tie rod illustrated on the opposite page. The part is approximately 15" long, comparatively slender, and there are six concentric diameters not including bevels and radius fillets. There's no question about concentricity, for the entire length of the part is ground in one setting by the infeed method. The machine is a CINCINNATI No. 3 Centerless equipped with Profile Truing Attachment over grinding and regulating wheels, special wheel mounts to accommodate 15" grinding and regulating wheels, and a special wide work rest. The setup met all accuracy and production requirements. This is another example of the Cincinnati Engineering Service which is available to help you in the selection of correct production methods for grinding all sizes and shapes of parts. ¶ Talk over your precision grinding operations with our engineers. They may be able to work out more productive and economical ways of handling your centerless and centertype grinding jobs.

ENTIRE LENGTH OF LONG SLENDER PART

Precision Infeed Ground

ON A CINCINNATI FILMATIC CENTERLESS

CINCI NATI



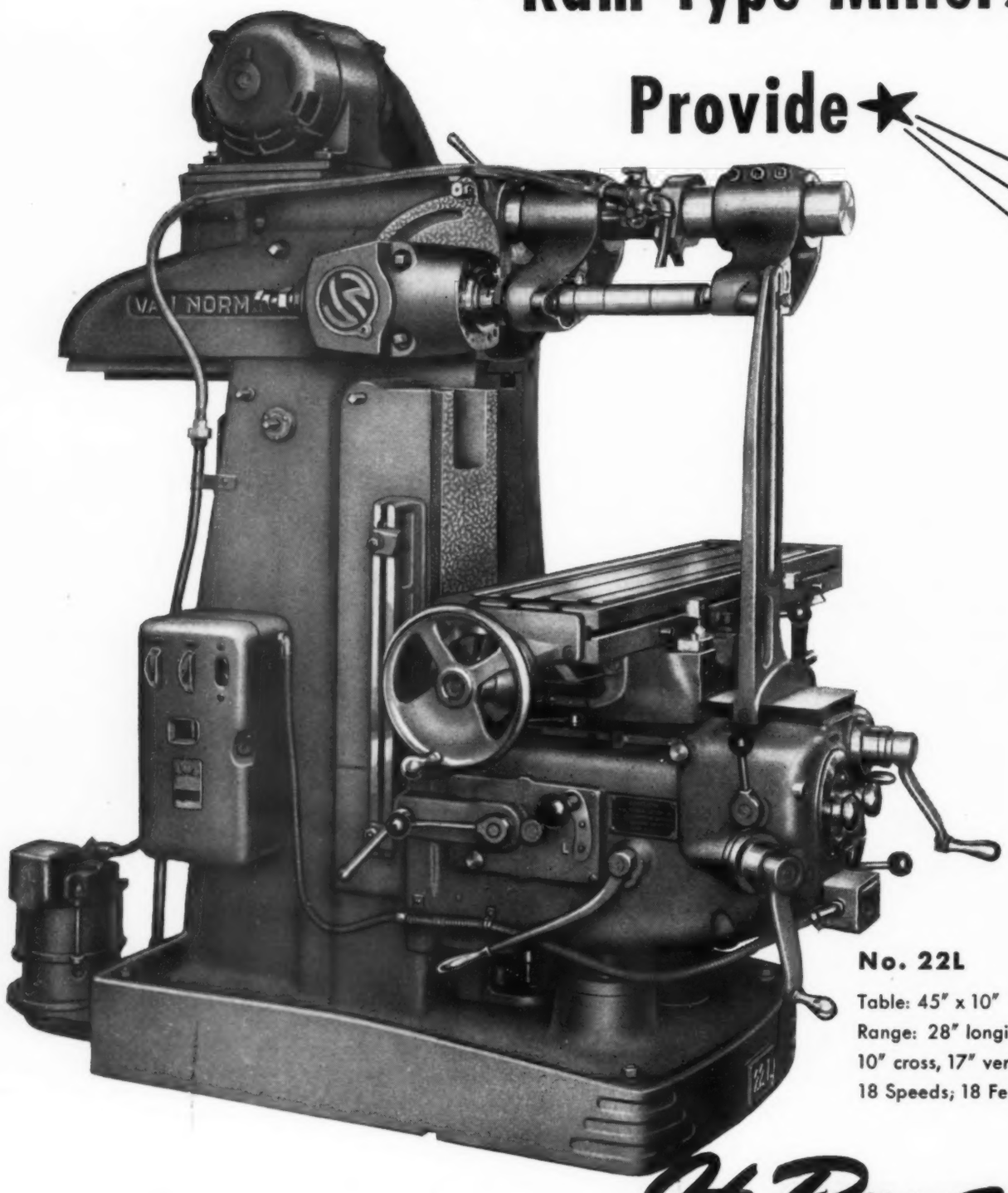
CINCINNATI No. 3 Centerless Grinder. Write for Catalog G-438-3 which contains complete specifications. Sweet's Catalog File gives a brief description.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

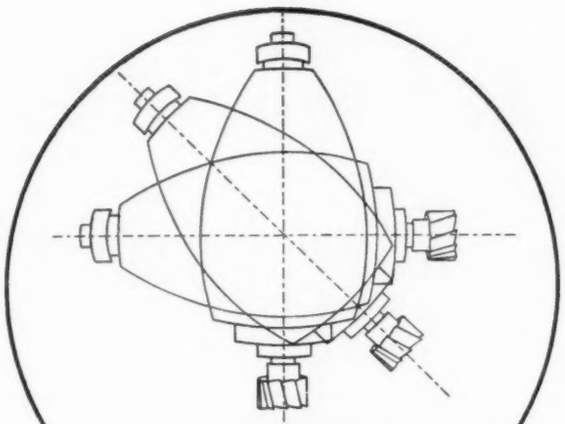
Van Norman Ram Type Millers Provide ★



No. 22L

Table: 45" x 10"
Range: 28" longitudinal,
10" cross, 17" vertical
18 Speeds; 18 Feeds

It Pays to



One Van Norman Ram Universal Miller gives You the work range of several types of millers.

★ ***Horizontal, Angular, Vertical Milling . . . All with ONE Miller***

★ ***Ease of Operation with Front and Rear Directional Controls***

★ ***Greater Work Range with Movable Ram***

Only Van Norman Ram Type Millers give you the adjustable cutterhead . . . an exclusive feature on Van Norman Ram Type Millers that permits you to perform every type of milling from horizontal to vertical . . . provide the work range of several single-purpose machines with one miller.

This advantage is especially important to those plants where daily milling requirements continually change. For example, one job calls for horizontal milling, the next vertical, etc. . . . with Van Norman millers the operators simply swivel the adjustable cutterhead to the required position and go ahead with the work. This advantage multiplies when a number of ram type millers are available.

In addition, the versatility of these millers enables operators to *increase production by as much as 50%* because idle machine and operator time is minimized. Work reset-ups on most jobs are practically eliminated.

Other Van Norman features that speed production, cut costs, include—finger-tip directional front and rear controls of all power feeds, movable ram, exclusive Van Norman rotary feed selector and large easy-to-read dials, plain or swiveling tables.

Minimize costly delays and get maximum milling production . . . use Van Norman Ram Type Millers. Write for complete information, today.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

Van Normanize"

Solving Reconversion Threading Problems

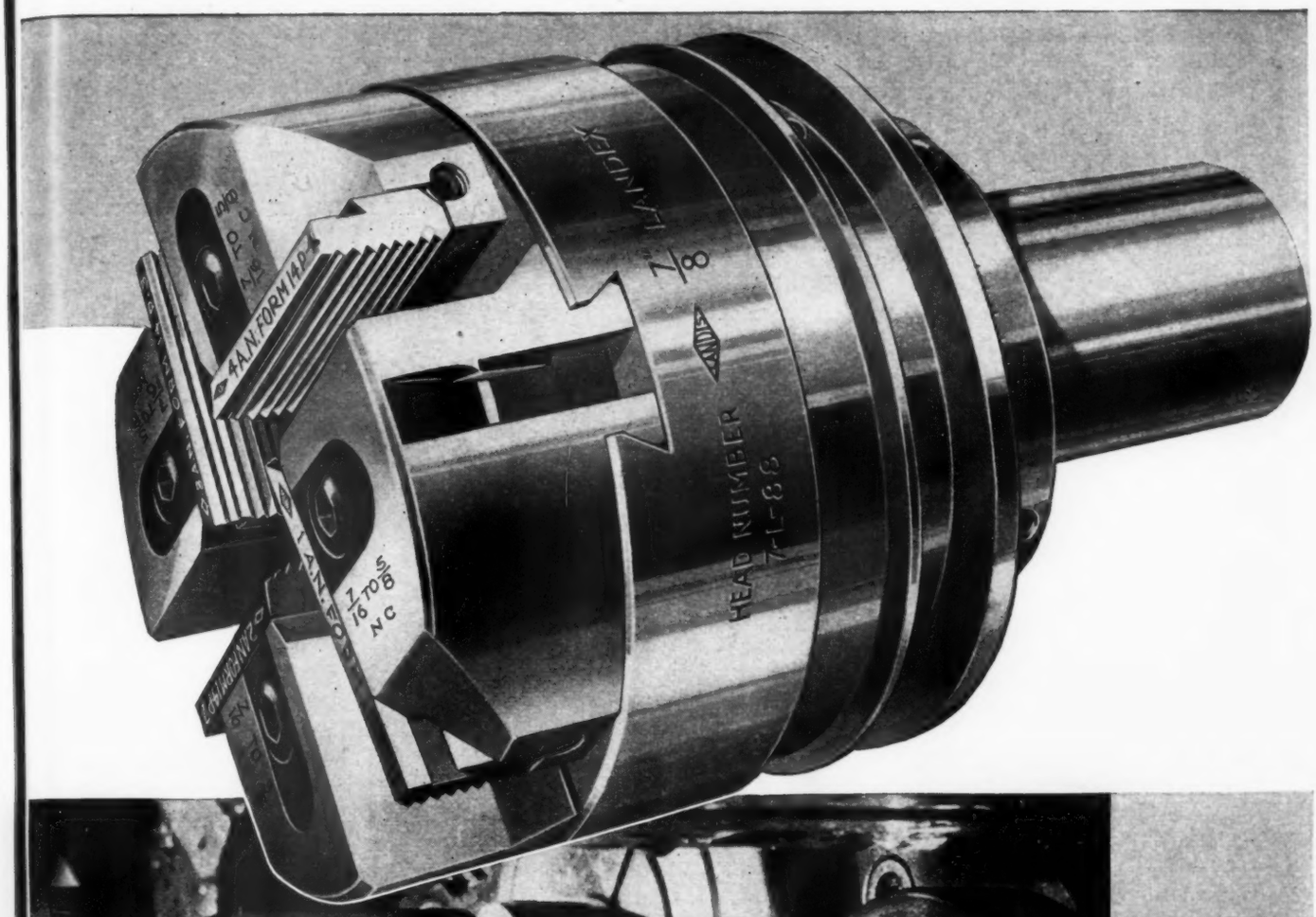
The LANDEX Die Head

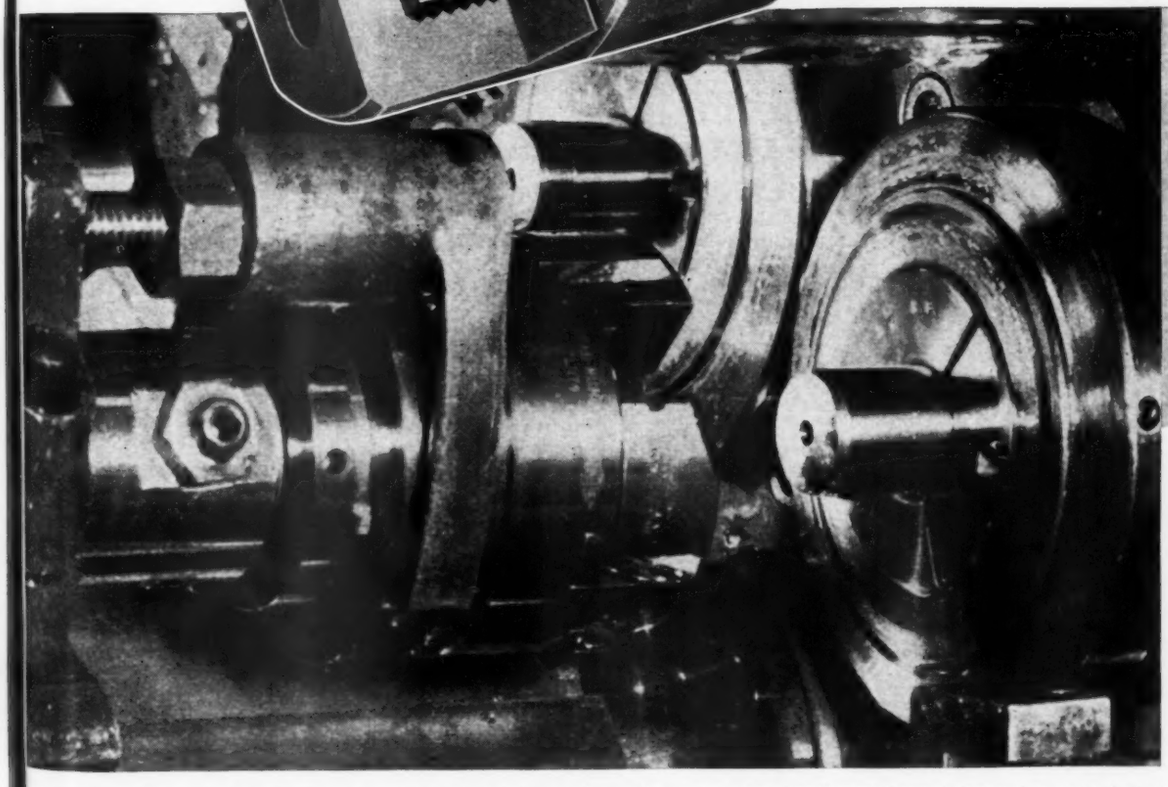
The Landex Hardened and Ground Die Head, as illustrated, was used extensively during the past five years in the production of munitions and other ordnance parts.

With reconversion Landex Die Heads and other LANDIS Thread Cutting Machines and Die Heads will just as efficiently and economically produce your threaded components to the fine accuracy and high production requirements of the new peace-time schedules.

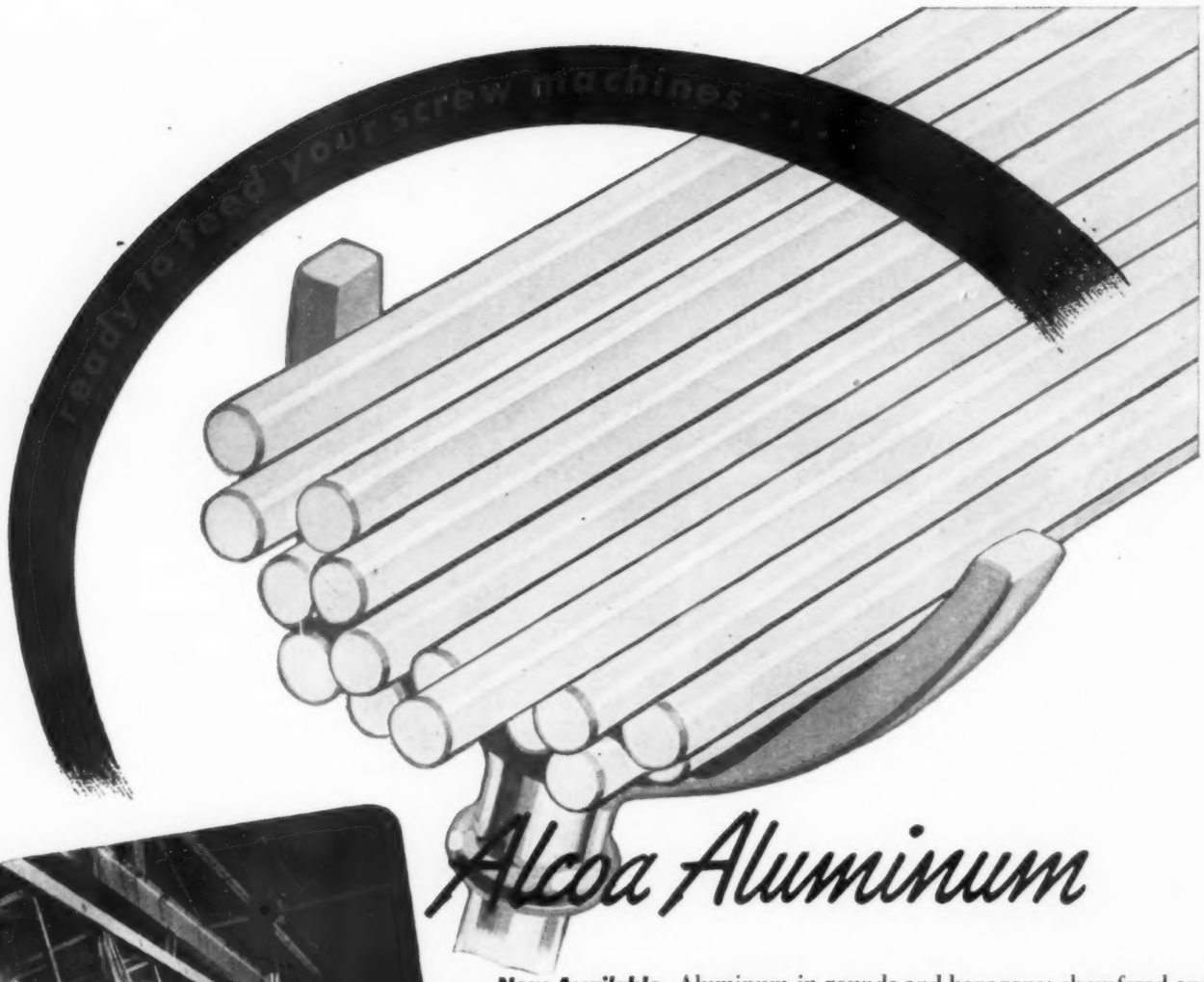
Write for Bulletin No. F-80

LANDIS





MACHINE CO. WAYNESBORO PENNA. U.S.A.



Alcoa Aluminum

Now Available. Aluminum in rounds and hexagons; chamfered and ready to go to work in your screw machines. Alcoa's distributors maintain large stocks of standard sizes for your convenience.

You Pay 22.2% Less Today. The base price of 1-inch diameter Screw Machine Stock (Alcoa Alloys 11S-T3 and 17S-T) is 7 cents less per pound than in September 1939, a 22.2% reduction. Other Alcoa Aluminum Screw Machine Stock prices have dropped correspondingly—same high quality, same careful preparation of stock, same advantages.

Should you need help getting a job going, Alcoa's servicemen are ready to advise you. For this help, call our nearest office, or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN **ALUMINUM**

ALCOA ALUMINUM

HOODOO SMASHERS!

America's newest and widest line of V-Belts—Allis-Chalmers' Texrope — solves problems that have hoodooed drives in almost every industry . . . see what they can do for you!

I ROUT THAT OLD BUGABOO, STATIC ELECTRICITY. I'M STATIC-RESISTING SUPER-7. MY BUILT-IN CONDUCTING ELEMENT CARRIES CHARGES TO THE MACHINE WHERE THEY'RE GROUNDED

Texrope V-belts are available nation-wide through Allis-Chalmers Dealers and Sales Offices

IT PAYS TO MAKE

ALLIS-CHALMERS

YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by A-C.

BULLETIN!

SPEED RECONVERSION WITH HELP OF NEW FREE A-C KIT!

Guide to "How to Take Reconversion Inventory" of Drives, Motors, Pumps

Help in the big job of reconverting for peacetime production is now offered to plants everywhere by Allis-Chalmers Mfg. Co., its district offices and distributors. To all who request it, we're sending the new "Reconversion Inventory Kit", planned to speed the task of determining the condition of your existing equipment — V-belt drives, motors, and centrifugal pumps — which will be used in reconverted production.

SUGGESTS PROCEDURE, STATES STANDARDS

Used by foremen, maintenance men, and engineers, the Kit is a real time-saver . . . leads efficiently to probable trouble spots, helps clear them up. Gives bearing tolerances, resistance formulae, etc., in compact, easily-used form. Check List appraisal charts help determine present and future condition of units inventoried.

HOW TO GET YOUR KIT

For your free Reconversion Inventory Kit, call your nearest Allis-Chalmers distributor or district office, or write Dept. 22, ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis.

A-1910

ALLIS-CHALMERS MFG. CO.
Dept. 22, Milwaukee 1, Wis.

Please send Reconversion Inventory Kit free of charge to:

Company.....

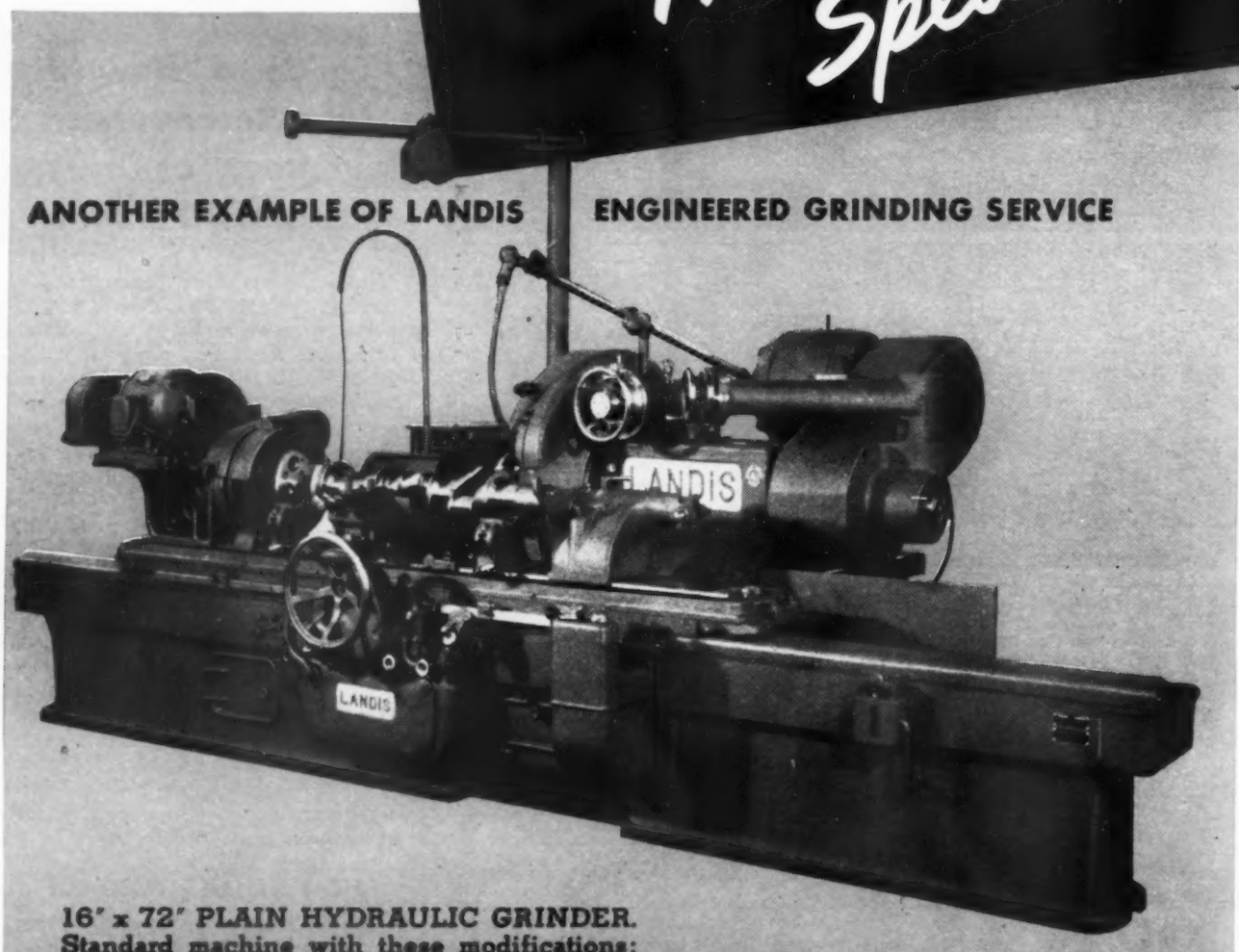
Address.....

.....

Attn. of Mr.....

Crankshaft Production Speeded

ANOTHER EXAMPLE OF LANDIS ENGINEERED GRINDING SERVICE



16″ x 72″ PLAIN HYDRAULIC GRINDER. Standard machine with these modifications: shoulder grinding attachment; hydraulic power infeed; ball bearing live work centers; table type work locators; jib crane; double work rest.

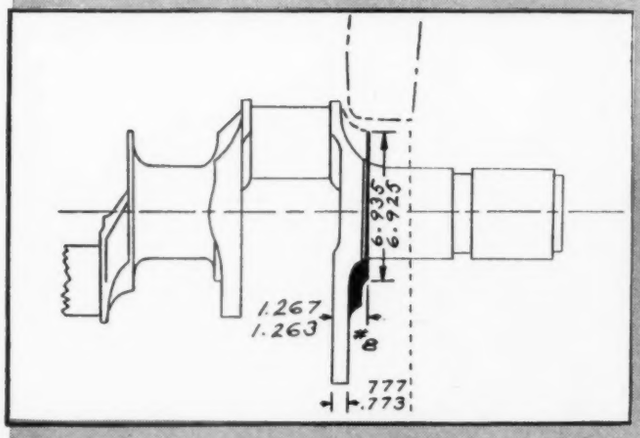
LANDIS TOOL *Precision Grinders*

LANDIS TOOL COMPANY

ONE GRINDING OPERATION *Eliminated* BY A MODIFIED STANDARD MACHINE

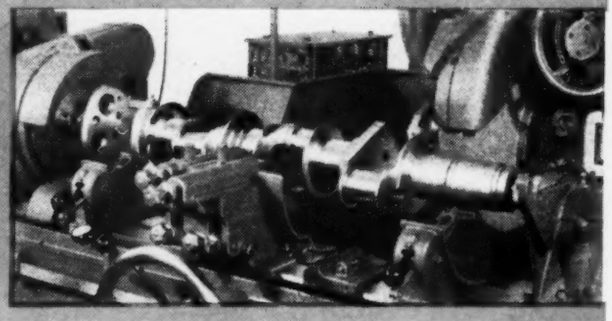
THE PROBLEM

To speed up production of airplane engines to meet wartime demands by reducing grinding time of certain crankshaft fillets. Two operations were necessary with manual feed.



THE SOLUTION

Starting with a standard machine use was first made of the maximum angle at which the wheel-base could be set without interfering with the work. This was only 4°. This small angle together with a formed wheel made possible plunge grinding of the fillet. The addition of Landis Tool hydraulic rapid infeed still further speeded the grinding and eliminated manual feed.



For maximum strength crankshafts of aircraft engines must have fillets and these had to be ground to close tolerances.

Landis Tool engineers were called in when a production problem was created by the demand of the armed services for more airplane engines. Starting with a standard machine—modifications were made that cut grinding time in half with a resulting increase in crankshaft production.

Your grinding problem may involve larger or smaller parts, but you can depend on the simplest and lowest cost solution. Our engineers are available to help you solve your grinding problems—call on them. 37

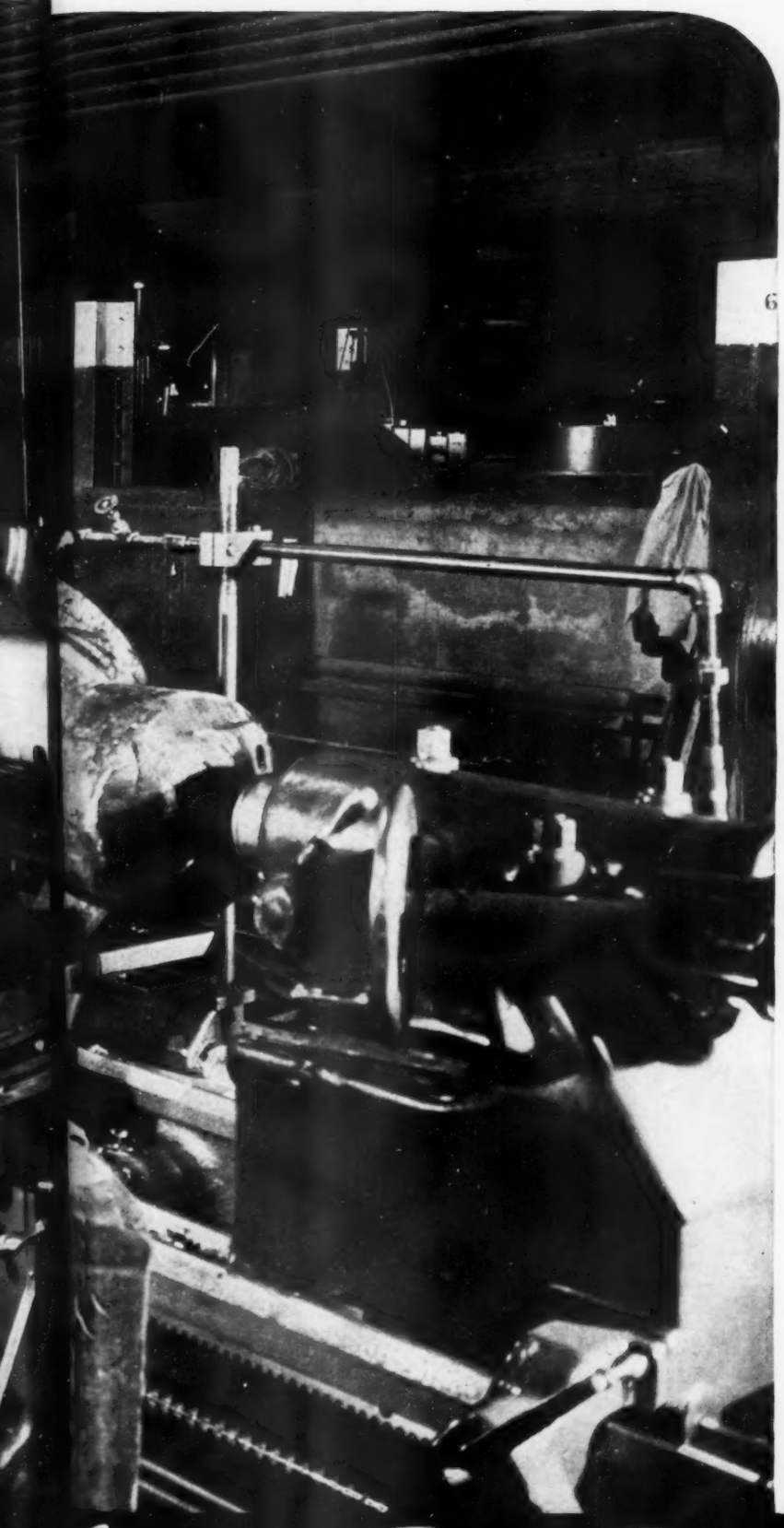
LANDIS TOOL *Company*

WAYNESBORO, PA.

PERFORMANCE

THE AMERICAN TOOL WORKS C

E FOR PROFIT...



"American" Lathes from the largest to the smallest are ready and "all set" to meet every challenge of peacetime production. The power, stamina and endurance built into "American" Lathes are proving invaluable to many a plant in this highly competitive era.

Dependable service, minimum shutdown for failures and repairs, coupled with an almost unbelievable ability to "keep going" under any and all conditions, are genuine "American" characteristics.

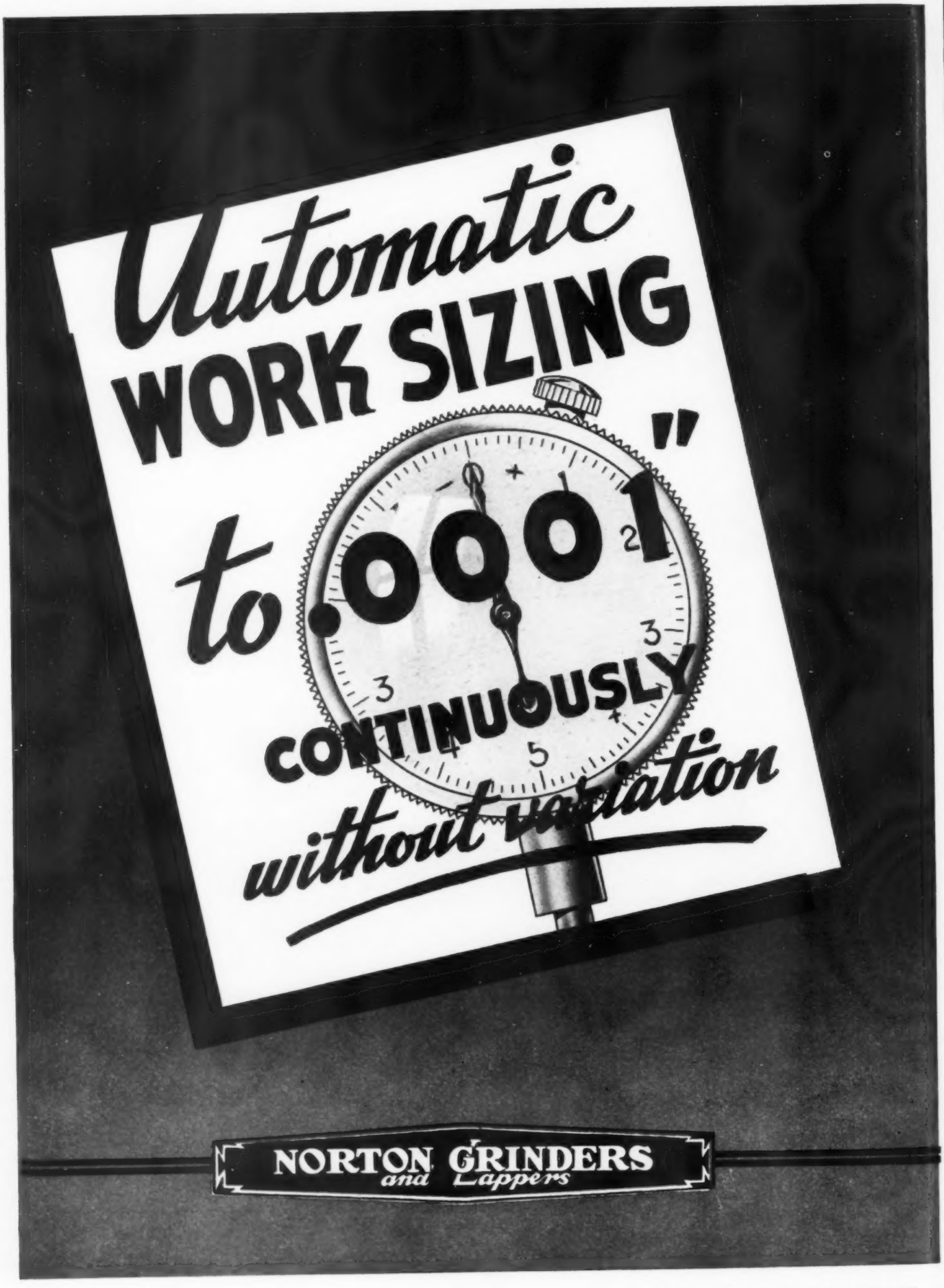
"American" Lathes are easy to operate, too—another feature that appeals to the operator as do their simplicity of design and complete freedom from complex mechanisms and manipulations.

"American" Lathes are an asset in any plant.

• *Send for Bulletin No. 87*

Courtesy of Allis-Chalmers Manufacturing Co.

s Lathes and Radial Drills **Cincinnati, Ohio U.S.A.**

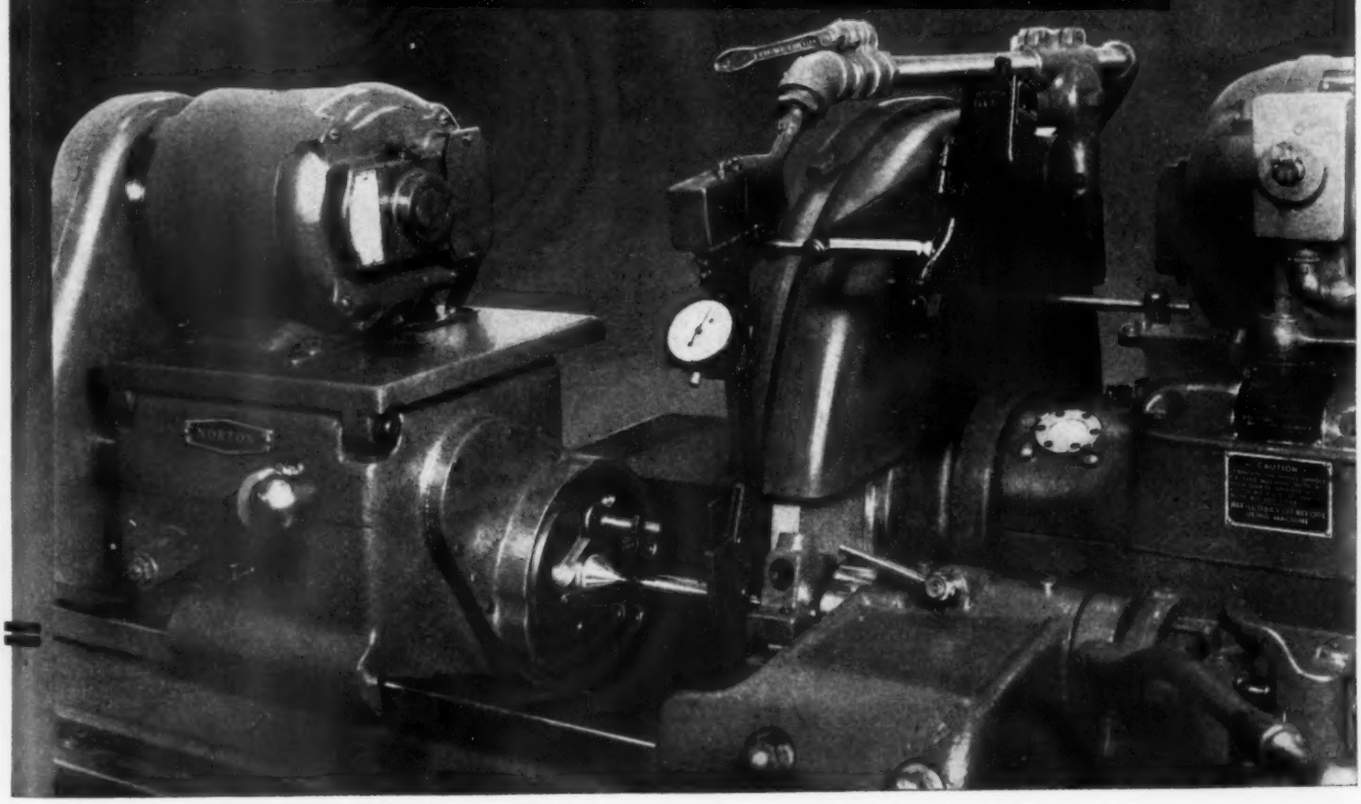

Automatic
WORK SIZING
to .0001"
CONTINUOUSLY
without variation
NORTON GRINDERS
and Lappers

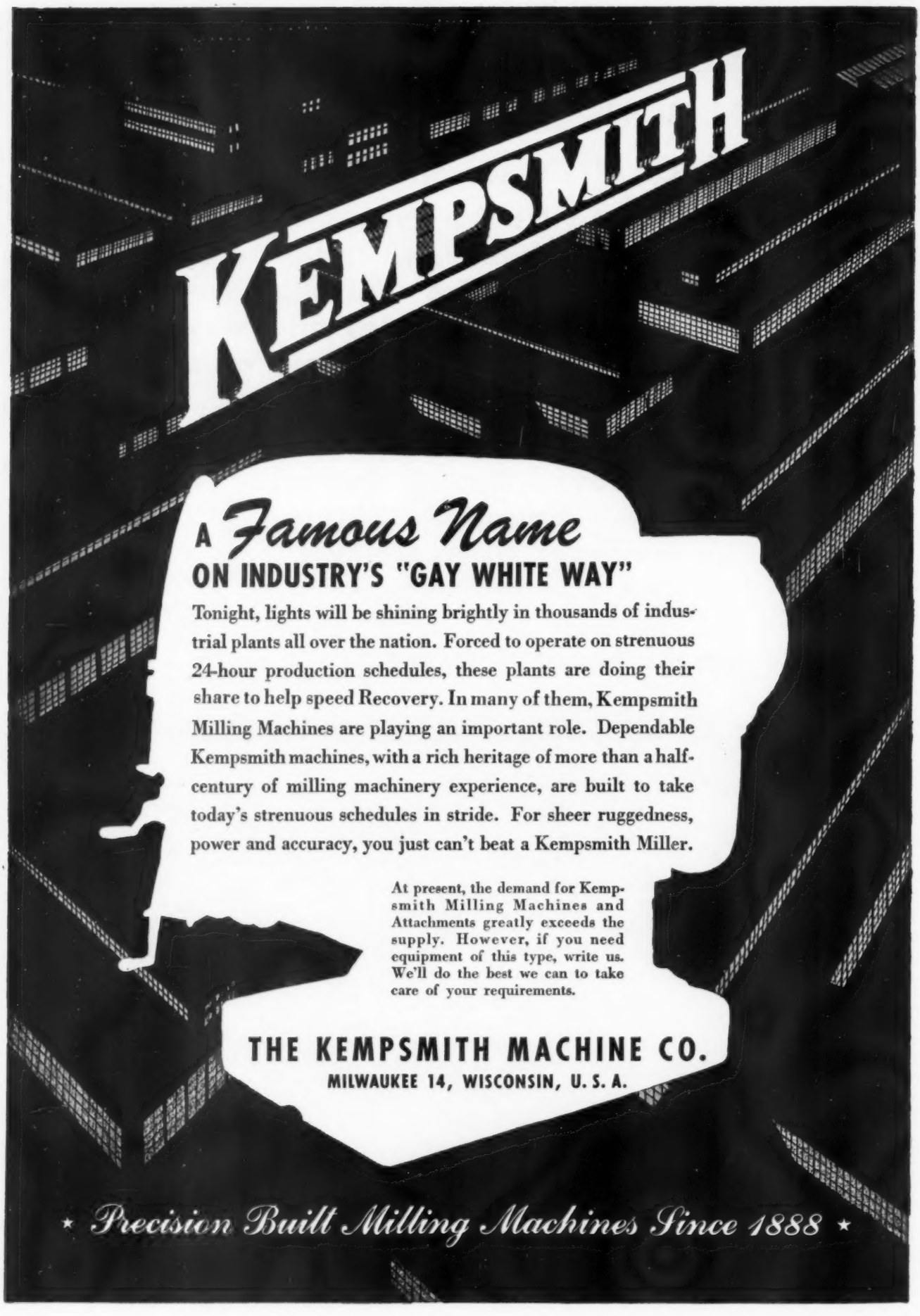
UNIQUE IN CONSTRUCTION
UNCANNY IN RESULTS

A standard Norton Type C Grinder equipped with the new Norton Automatic Sizing Device will click out work hour after hour, day after day to accuracy limits of a tenth of a thousandth of an inch. Results:

Increased Production
Improved Quality Control
Lower Operating Costs
Minimum Operator Skill
Less Operator Fatigue

NORTON COMPANY WORCESTER 6, MASS.




KEMPSMITH
A Famous Name
ON INDUSTRY'S "GAY WHITE WAY"
Tonight, lights will be shining brightly in thousands of industrial plants all over the nation. Forced to operate on strenuous 24-hour production schedules, these plants are doing their share to help speed Recovery. In many of them, Kempsmith Milling Machines are playing an important role. Dependable Kempsmith machines, with a rich heritage of more than a half-century of milling machinery experience, are built to take today's strenuous schedules in stride. For sheer ruggedness, power and accuracy, you just can't beat a Kempsmith Miller.
At present, the demand for Kempsmith Milling Machines and Attachments greatly exceeds the supply. However, if you need equipment of this type, write us. We'll do the best we can to take care of your requirements.
THE KEMPSMITH MACHINE CO.
MILWAUKEE 14, WISCONSIN, U. S. A.
★ Precision Built Milling Machines Since 1888 ★

CLEVELAND FOUR POINT PRESS

500 TONS CAPACITY . . . . . 108 INCHES BETWEEN UPRIGHTS

This Modern Cleveland Four Point Press is equipped with an electrically controlled hydraulic friction clutch and brake and, in addition, the flywheel is arranged with an air brake to bring it to a quick stop, when necessary. The slide is air counterbalanced and the uprights are provided with openings which permit the feeding of material from right to left.

The Press has a 24″ stroke, 6″ adjustment, 60″ shut height and operates at 14 RPM.

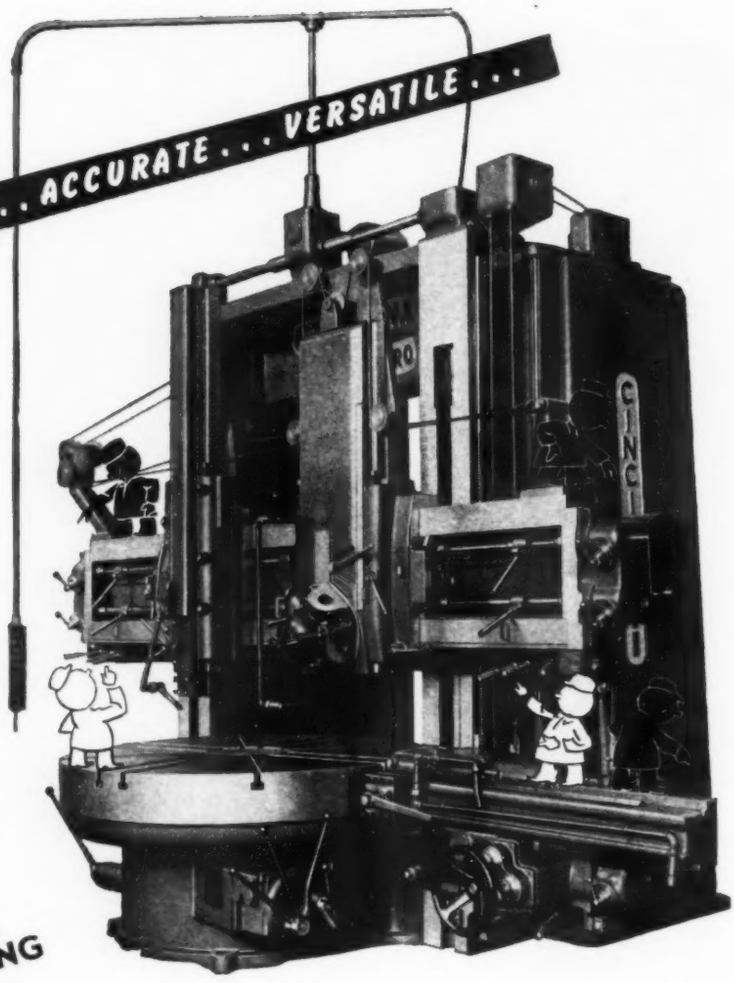
This type of Modern Press can be furnished in sizes and capacities to suit requirements.

THE CLEVELAND PUNCH & SHEAR WORKS COMPANY

Cleveland 14, Ohio

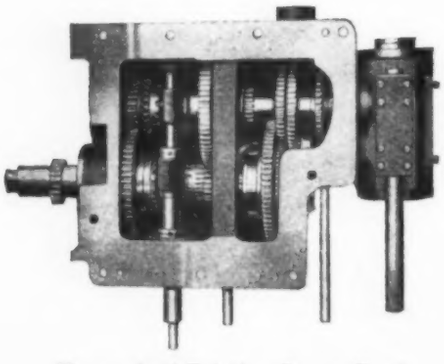
NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • PITTSBURGH

IT'S FAST . . . ACCURATE . . . VERSATILE . . .



The NEW and IMPROVED CINCINNATI HYPRO Boring Mill

FEATURING INDEPENDENT FEED, RAPID TRAVERSE AND REVERSING MECHANISM FOR EACH HEAD



Hypro Anti-Friction Power Feed and Traverse Box

An individual unit is provided for each Head and contains the complete power feed, rapid traverse, reversing mechanism and safety clutches.

All levers for feed, traverse and reverse are placed in front of the machine convenient to operator's working position.

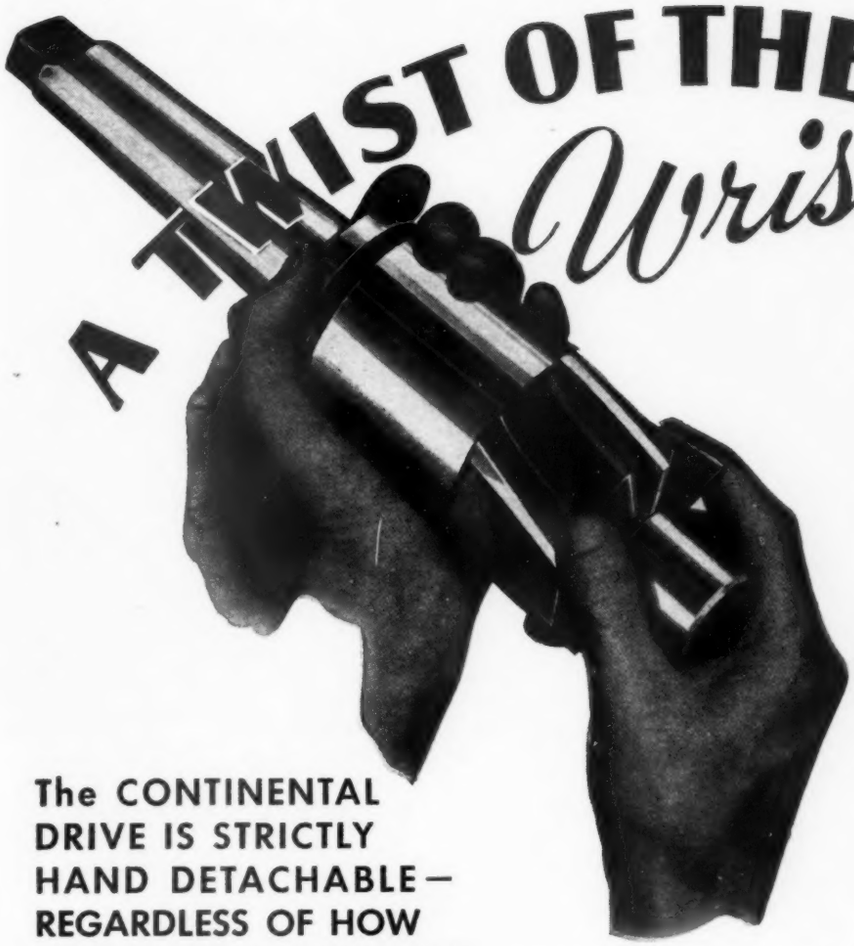
Each box contains hardened alloy steel gearing mounted on multiple splined shafts and anti-friction bearings. Complete unit is enclosed and runs in a bath of oil supplied by a pump incorporated in the box.

THE CINCINNATI HYPRO PLANER COMPANY

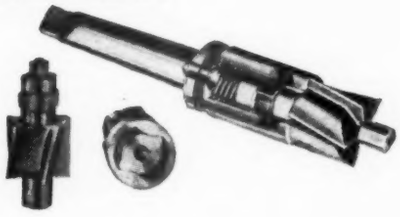
PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

A TWIST OF THE *Wrist*



The CONTINENTAL DRIVE IS STRICTLY HAND DETACHABLE—REGARDLESS OF HOW SEVERE THE OPERATION HAS BEEN



With an ever-widening range of practical uses, the Continental Counterbore is proving a favorite standard cutting tool in all types and sizes of machine shops. Of rigid and simple construction, with patented features, it has long been outstanding in American industry. There's a reason: Note in illustration at left the Continental indestructible drive. It is composed of two driving lugs formed on the cutter shank, with two corresponding abutments on the inside of the holder. There is an aligning bearing above and below the driving lugs that brings the cutter and holder concentric, and prevents the cutter from being forced out of alignment. The cutter and holder are engaged and disengaged by revolving the cutter a quarter turn *by hand.* No tools or equipment are necessary.

CONTINENTAL TOOL WORKS

Division of Ex-Cell-O Corporation

DETROIT 6, MICHIGAN

CONTINENTAL TOOL WORKS

CTW

EX-CELL-O CORPORATION

Continental

CUTTING TOOLS

- Boring Bars and Tools
- Broaches
  Broach Pullers
  Broaching Fixtures
- Core Drills
- Counterbores and Countersinks
- CTW Drive Holders
- Counterbores (Tool Room Sets)
- Counterbore Pilots
- Inserted Blade Cutters
- Carbide Tipped Cutters
- Form Relieved Cutters
- Milling Cutters
- Thread Milling Cutters
- End Mills
- Side Mills
- High Speed Steel Reamers
- Carbide Tipped Reamers
- Shell Reamers
- Inverted Spotfacers
- High Speed Steel Tool Bits
- Carbide Tipped Tool Bits
- Circular Form Tools
- Cut-off Tools
- Flat Form Tools
- Dovetail Form Tools

45-46

To right: **Illustrated here is an Ex-Cell-O Junior Single-End Precision Boring Machine (Style 2112-A) with bronze parts bored, faced, turned and recessed on it. The parts are two mating halves of a metering chamber. The front spindle carries the bottom half of the part and the rear spindle carries the top half of the part. One cycle of the machine completely finishes all internal surfaces—boring, facing, turning, and recessing (3 bores, 5 faces, turn one diameter, recess mating diameters). Both halves are machined simultaneously. By machining all internal surfaces and the mating surfaces at the same time, complete concentricity and accurate mating of the two halves are insured. After the two halves are assembled, the measuring chamber is then turned on the O.D. on another Ex-Cell-O Style 2112-A Precision Boring Machine.**

WHAT'S AHEAD

FOR YOUR BUSINESS?

Civilian Production Also Demands Equipment of the Highest Possible Efficiency—*See Ex-Cell-O First!*

A WIDE RANGE OF BORING, TURNING AND FACING OPERATIONS IS POSSIBLE THROUGH THE EXTREME FLEXIBILITY OF EX-CELL-O PRECISION BORING MACHINES

Low unit costs will be essential if an expanding postwar market is to be yours. Ex-Cell-O is ready to assist you in realizing this objective. Ex-Cell-O experience in pioneer development of precision machine tools—including the first commercially successful horizontal-type precision boring machine and precision thread grinder—is at your service. Whether your peacetime production plans involve standard or special machines, re-tooling, cutting tools, or miscellaneous production parts, you should decide now to see *Ex-Cell-O!* Contact the Ex-Cell-O head office in Detroit, or any of the Ex-Cell-O representatives stationed in 32 other leading industrial centers throughout the United States and also in Canada.

Where increased production, high accuracy, and greater economy through multiple operations are required . . . See EX-CELL-O First!

EX-CELL-O CORPORATION · DETROIT 6

Standard and Special Multiple Way-Type Precision Boring Machines

•

Continental Cutting Tools

Precision Thread Grinding Machines

•

Precision Lapping Machines

•

Broaches and Broach Sharpening Machines

Multiple Drilling and Other Special Purpose Machines

•

Tool Grinders

•

Hydraulic Power Units

Grinding Spindles

•

Drill Jig Bushings

•

Aircraft and Miscellaneous Production Parts

Fuel Injection Equipment

•

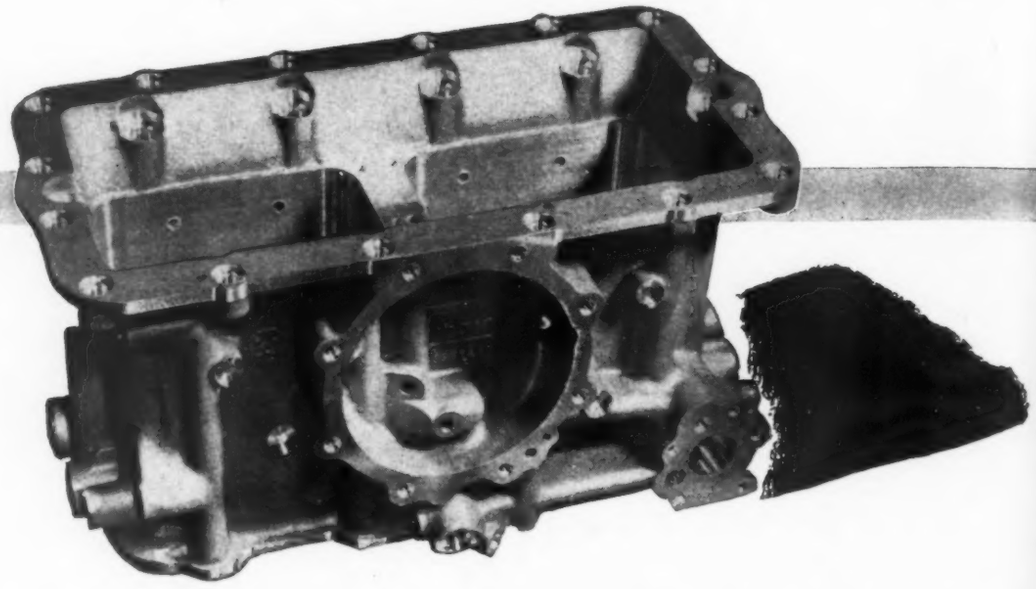
R.R. Pins and Bushings

•

Pure-Pak Paper Milk Bottle Machines

45—94

Eliminates Hand work on



"IT WOULD have been extremely difficult to build carburetors to the high standards set by the Army Air Corps if it had not been for the lead screw Tapping & Threading Machines produced by Warner & Swasey," reports the Illinois Division of Bendix Aviation Corporation, Chicago.

One example of the work done at Bendix on Warner & Swaseys is a complicated magnesium casting used as a throttle body for an aircraft carburetor. This part calls for 8 holes tapped $^{5}/_{16}$"- 18, $^{5}/_{8}$" deep to a Class 4 fit and 16 holes tapped $^{7}/_{16}$"- 20, $^{3}/_{4}$" deep to a Class 4 fit. Because these tapping operations are near the completion of the machining process on the part, error in any tapped thread would result in costly scrap loss.

Today, Bendix taps these threads completely by machine—eliminating all hand work and reducing the human error element to an absolute minimum. The result: better production, far lower scrap loss on a tough job!

What Warner & Swasey Precision Tapping & Threading Machines have done here and in dozens of other plants in war production, they can do for you in getting better peacetime products at lower costs. We'll be glad to make test runs of sample parts to show you what these machines can do!

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

Class 4 threads at Bendix

Tapping 8 holes to a Class 4 fit, 5/16"-18 thread in magnesium on No. 11 Warner & Swasey Precision Tapping & Threading Machines.

TURRET LATHES, SADDLE AND RAM TYPES – CHUCKING AND BAR TOOLS – MULTIPLE SPINDLE AUTOMATICS – PRECISION TAPPING AND THREADING MACHINES

WARNER & SWASEY
Machine Tools
Cleveland

A-C's Electronic Heater Gives You

NEW A-C WAY

A-C's Electronic Heater cuts production corners with new service features, wide application range.

STURDY, Long-Life Oscillating Tubes — fully protected by overload relays, water filters and pressure switches.

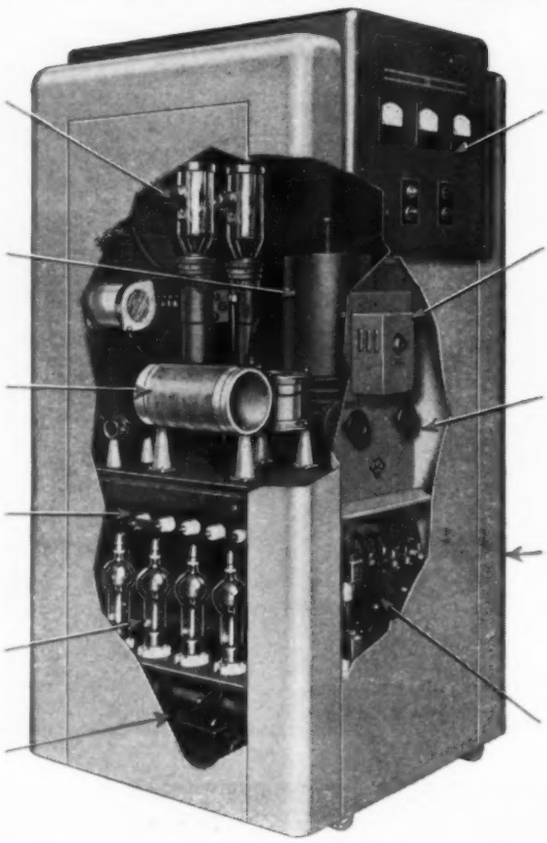
NEW Coupling System, developed by A-C, keeps losses low, permits adaptation to most applications without use of radio frequency transformers.

CHOKE COIL protects rectifier tubes from damage by high-frequency radio currents.

HEAVY-DUTY Transformer for handling overloads, other extreme operating conditions.

3-PHASE Rectifying System obtains maximum power from electronic heater, prevents unbalanced load on power lines.

INDIVIDUAL Filament Transformer for each rectifier tube, easy to get at.



LARGE Indicator Panel for easy reading — shows at a glance when power is on, grid and plate currents, filament voltage.

AUTOMATIC Timer controls heat sequence from 2 seconds to 20 minutes, makes unit easy for unskilled operators to use.

ALL Controls on one panel for easy change in applications. No other internal adjustments needed. Protected from tampering by door and lock.

MODERN Industrial Cabinet encloses complete unit. All-Steel construction. Mounted on casters for mobility.

SAFETY FEATURES: Heavy-duty control, high water-temperature switch, fuses, interlocking switches on doors to protect operators.

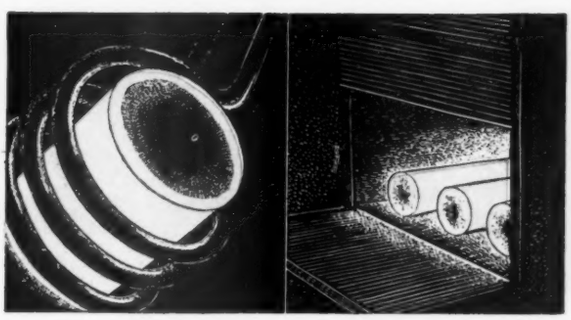
Pioneer Builders of Electronic Equipment for Industry.

Allis A-C

Fast, Uniform Production! Compare—

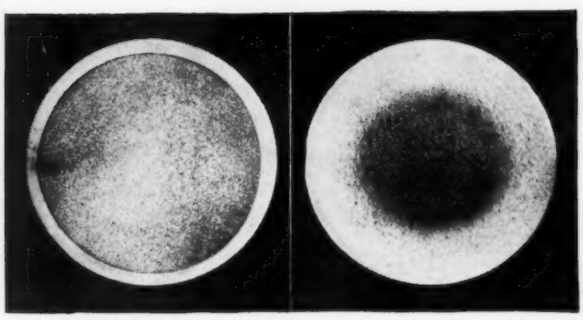
v. OLD WAY!

A-C's Electronic Heater is clean, automatic — easy to operate . . . increases output, cuts cost.



FAST Electronic Heat *v.* SLOW Furnace Heat

A-C's Electronic Heater doubles and redoubles output of hardened metal parts because entire heating operation can be completed in a matter of seconds! Compare this with slow heat, time-waste of conventional methods.



NEW Controlled Heat *v.* OLD Uncontrolled Heat

Compare ideal hard surface and tough core of metal at left as treated by Allis-Chalmers Electronic Heater . . . with deep, irregular hardening and brittle core of metal at right, as treated by conventional methods.

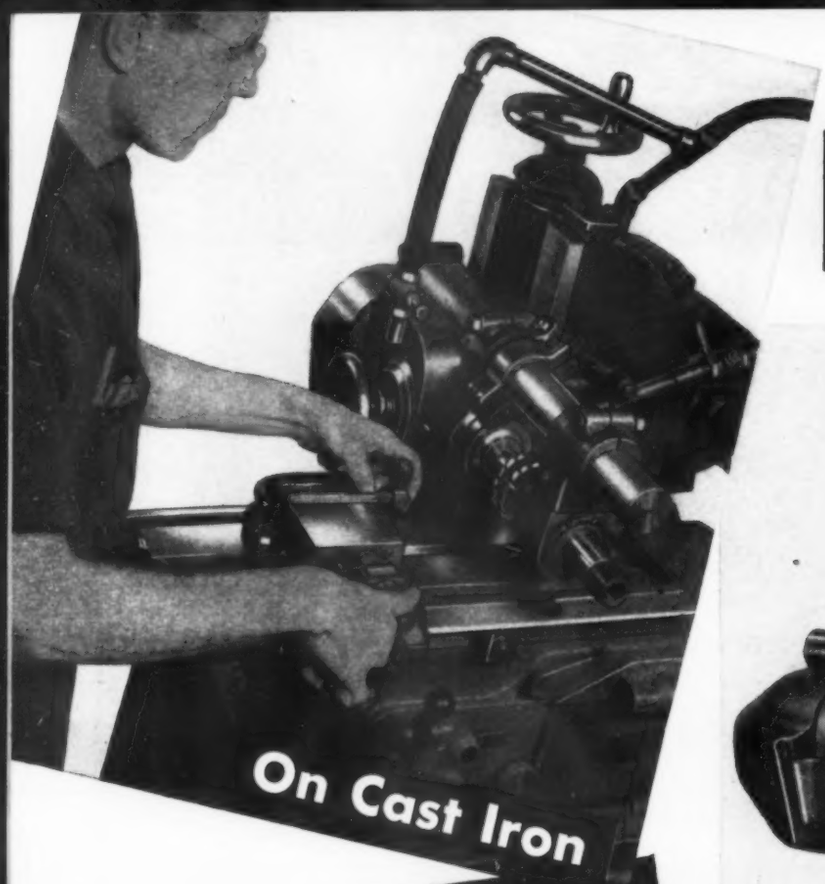
INDUCTION HEATING at its newest and finest — that's what Allis-Chalmers Electronic Heater offers you! This great, new all-in-one production tool gives you flexible, selective, controllable heat for brazing, annealing, forging — yet it's simple to operate, requires no special skills. Write for further details about this modern answer to many modern production problems, or send samples for free laboratory test. No obligation. ALLIS-CHALMERS, ELECTRONIC DEVICES SECTION, MILWAUKEE, WISCONSIN.

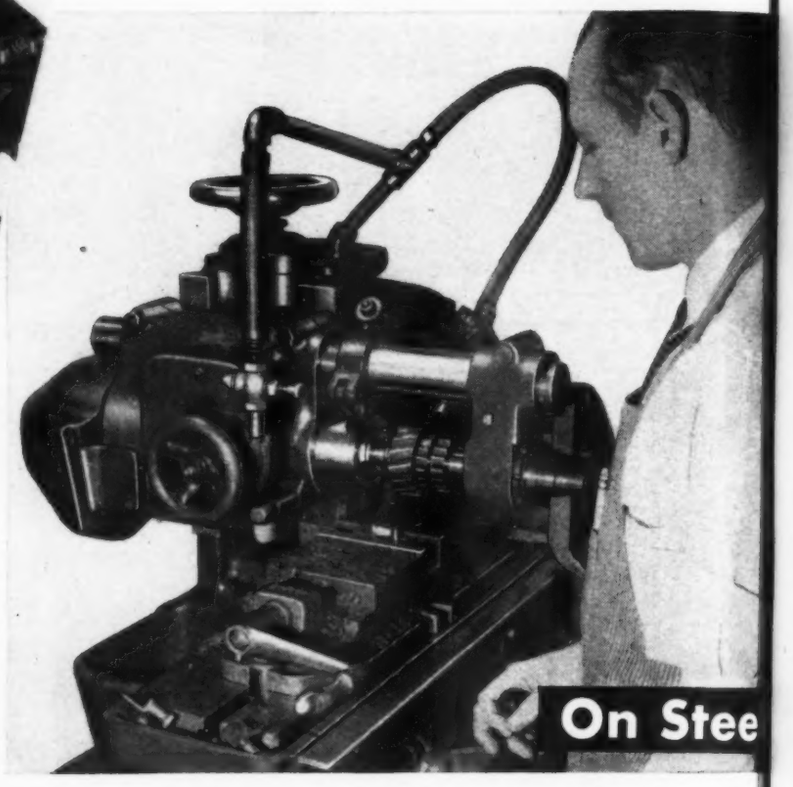
A 1972

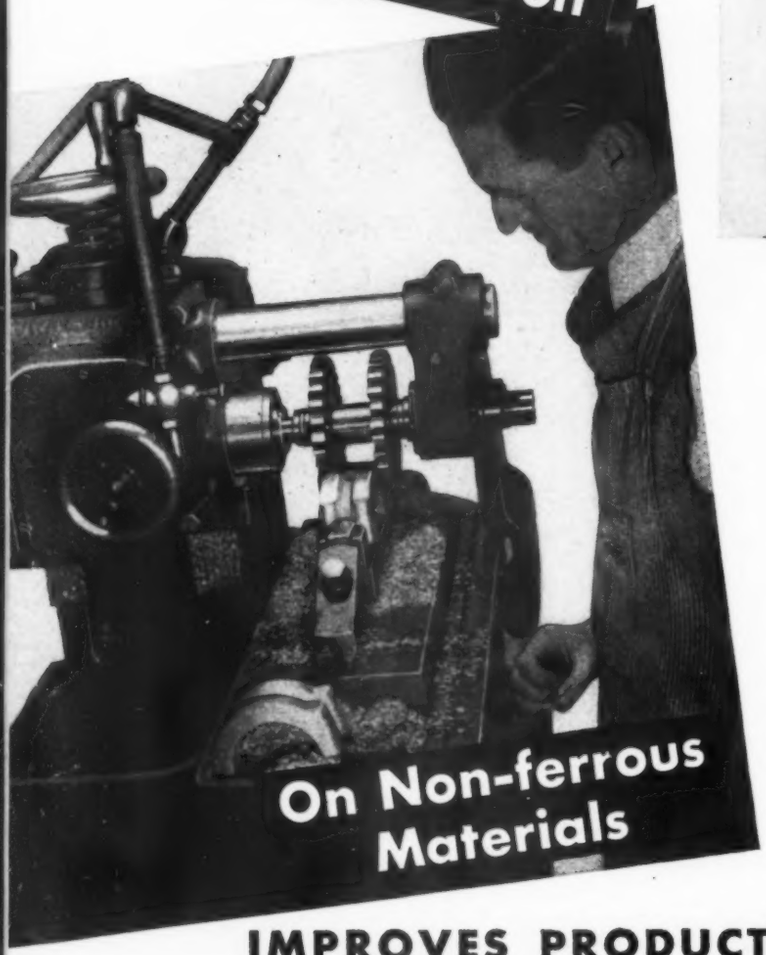
HEAR THE BOSTON SYMPHONY: *Saturday, American Broadcasting Co.*

Chalmers MILWAUKEE WISCONSIN

No 000's







Investigate the No. 000 Plain Milling Machine's many features for **High Output** with **Maintained Accuracy.**

B·S BROWN & SHARPE MFG. CO
PROVIDENCE 1, R. I., U. S. A.

IMPROVES PRODUCTION OPPORTUNITIES ON THE QUALITY MILLING OF SMALL PARTS

BROWN &

OPERATING EFFICIENCY REDUCES MILLING COSTS

on a wide variety of materials

Simple Set-up

Single table dog engages cutting feed.

Speed and **feed** changes quickly and easily made.

Transverse and **vertical** adjustments conveniently accomplished from front of machine.

Fast Operation

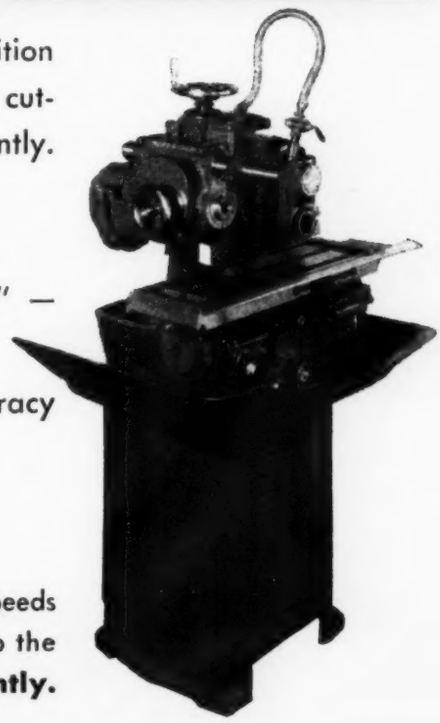
Automatic milling cycle reduces non-cutting time to a minimum.

Rapid advance of work to cutting position by power and the 3/8" minimum length of cutting feed permits milling short cuts efficiently.

Accuracy

Feed engaged within accuracy of 1/16" — permits close timing.

Consistent reversal of table within accuracy of .002" — ideal for blind cuts.



Broad ranges of feeds and speeds permit using cutters down to the smallest end mills — **efficiently.**

SHARPE

If it's to be

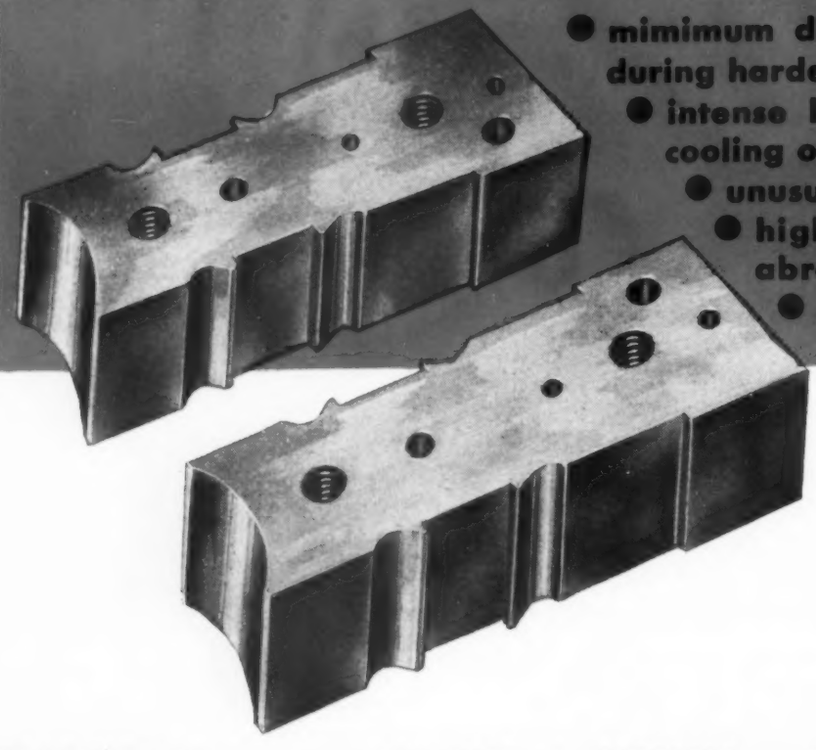
hundreds of thousands

use CROMOVAN

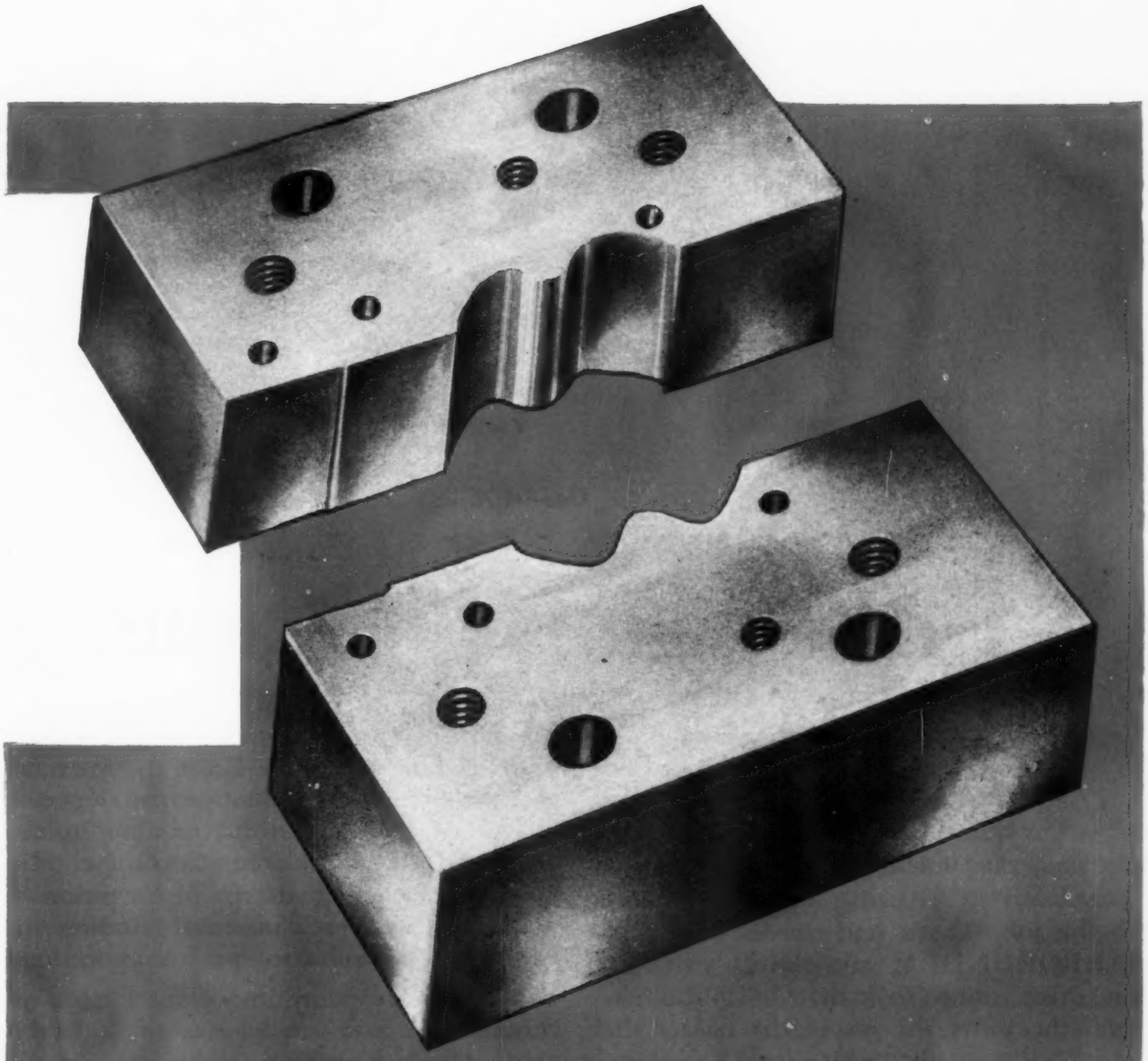
STEEL DIES...

Where it is advantageous to have dies that will assure big figure production and extra long life, Cromovan Triple Die Steel is recommended. The following outstanding features of Cromovan dies are proved in performance histories:

- **mimimum dimensional change during hardening**
- **intense hardness from air cooling or oil-quenching**
- **unusual depth of hardness**
- **high resistance to abrasion**
- **good machinability**



McKEESPORT, PA. NEW YORK • HARTFORD PHILADELPHIA • PITTSBURGH



If you have a cutting or forming operation

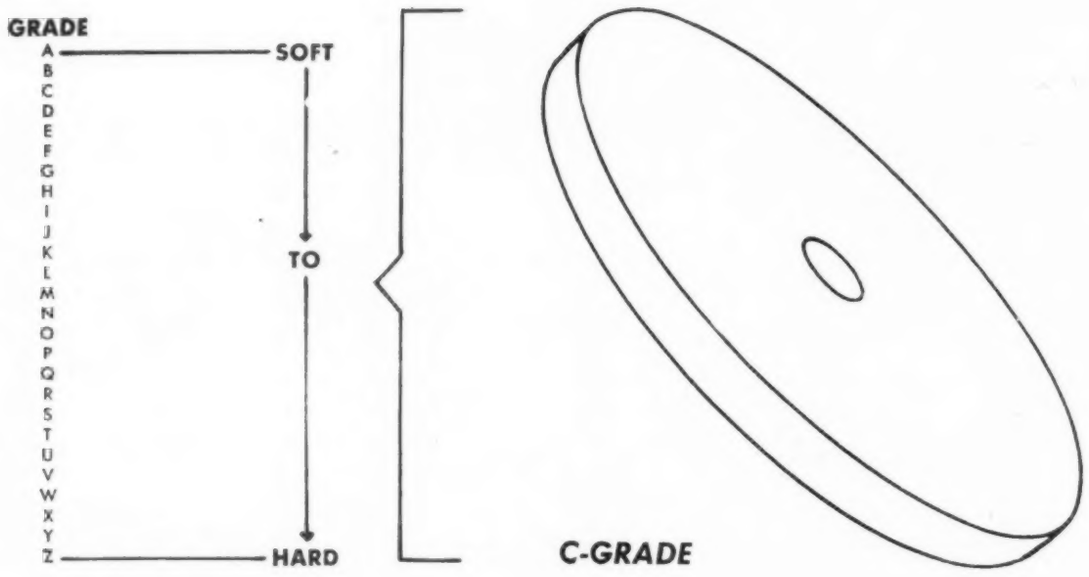
where production requirements are unusual—

find out the details about Cromovan's possibilities.

Call in

Firth-Sterling
STEEL COMPANY

CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES



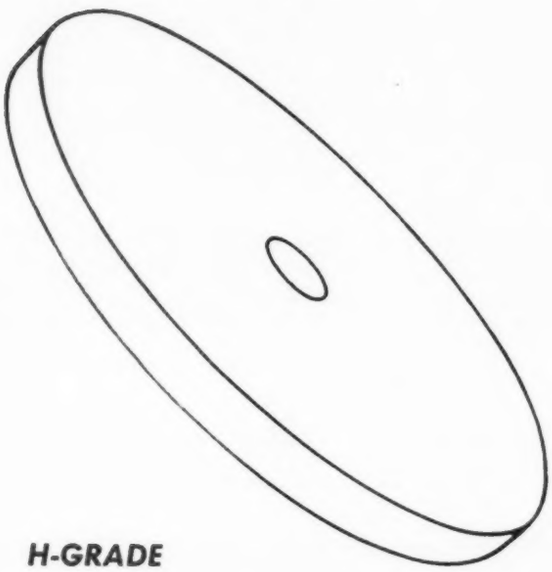
There's more to grinding

The A, B, C's which appear as identification on a grinding wheel help simplify proper grade selection. By clearly showing relative hardness, they make your choice quicker, easier...aid in assuring the right grade for the job. That's one reason wheels by CARBORUNDUM are plainly marked. But, there's more to it than the old chestnut, "the softer the metal, the harder the wheel." It's not that easy.

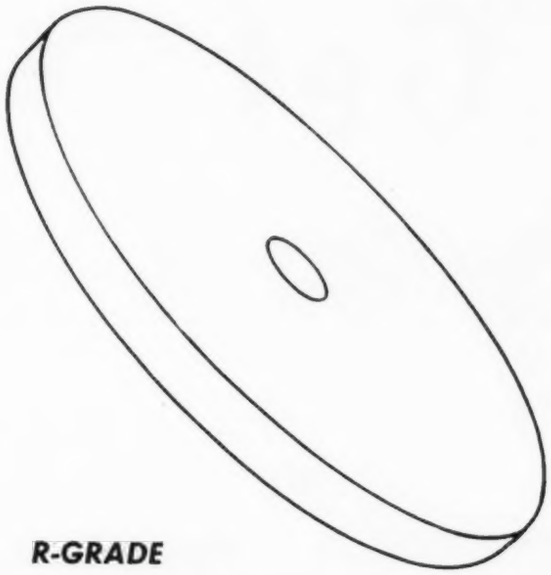
The same grade reacts differently at various wheel speeds. The condition of the machine and the amount of vibration can make a difference. Desired finish...required tolerance must be considered. Coolant conditions vary. The actual type of operation—snagging, surfacing, internal grinding or whatever it is—influences practical selection.

Yes—there are many important factors to check before you can be sure of the right grade designation for the job.

A good rule for good grinding... **CALL**



H-GRADE



R-GRADE

grades than the A, B, C's

That's why we suggest consulting your CARBORUNDUM salesman or our distributor's representative. These men work throughout the year on a wide variety of grinding problems. They are familiar with grinding in production...in tool rooms... wherever it is used. They have practical knowledge and experience to help you pick exactly the wheel you need for the job.

Assisting these representatives in the field are our Abrasive Engineers. Specialized experts, they are equipped to analyze uncommon problems...recommend sound solutions. And, here in our modern laboratories are scientists and technicians who are working on the application of abrasive developments to changing grinding practices.

This *three way* service is easy to use. Just plan to talk "grinding" soon with your CARBORUNDUM representative. He'll be glad to assist you. The Carborundum Company, Niagara Falls, New York.

IN CARBORUNDUM

TRADE | MARK

ABRASIVE WHEELS

Silicon Carbide
Aluminum Oxide
Diamond

COATED AND BONDED ABRASIVES

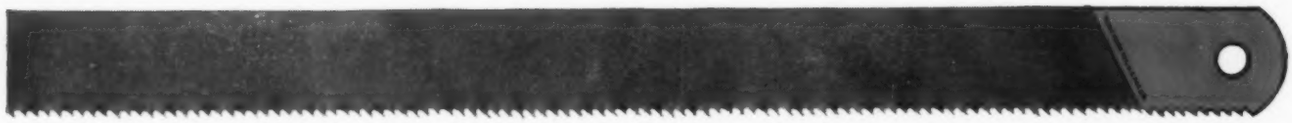
Paper and Cloth Combination
Sheets, Rolls, Discs
Cylinder Hones
Sticks, Stones & Rubs
Specialties

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

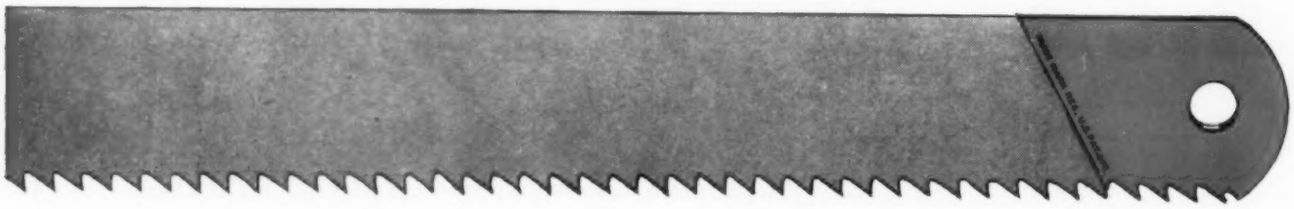
Get SIMONDS



"RED END" HACKSAW BLADES

. . . AND GET A LONGER RUN

FOR YOUR MONEY



SEE SIMONDS SOUND-FILM, in color, showing how to get the best results and longest service out of the finest blades made . . . SIMONDS "Red End" Blades for Hand and Power Hacksawing. You can arrange with your Industrial Supply Distributor for a showing of this interesting movie. Or write to the nearest Simonds office.

SIMONDS SAW AND STEEL CO.
FITCHBURG, MASS.

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

see many
GOOD THINGS AHEAD

Photo Courtesy Pantex Pressing Machine, Inc.

It is reported that . . . . . .

One of the country's largest corporations announces that it will build a million-dollar plant for the making of prefabricated houses. Plans call for the starting of production about the middle of 1946, and capacity will be 1650 per year. *U. S. Steel Corp.*

get ready with CONE for tomorrow

A large chemical company promises to build a million-and-a-half dollar plant for the production of synthetic caffeine. The raw materials will be air and water. *Monsanto Chemical Co.*

get ready with CONE for tomorrow

During the war, the principle of mass production was applied to the making of marine chronometers, increasing the output from 400 a year to thousands. *Hamilton Watch Company.*

get ready with CONE for tomorrow

One of our leading technical colleges is planning to establish a gas turbine research laboratory which will include a supersonic wind tunnel and special facilities for the study of compressors, combustion devices, jets and other gas turbine elements. *M.I.T.*

get ready with CONE for tomorrow

Indication of industry's increasing use of the multiple spindle automatic is the recent announcement of the new five-spindle machine built by Warner & Swasey.

get ready with CONE for tomorrow

In a new radio-phonograph set the radio unit can be readily removed and used separately. *Westinghouse.*

get ready with CONE for tomorrow

A new mechanical cotton picker is designed to take advantage of the recently developed method of defoliating the plant by means of a chemical spray. *Charles R. Berry, Vicksburg, Miss.*

get ready with CONE for tomorrow

An optical company announces the development of a light-polarizing glass. Previous polarizers have been made of natural crystals or plastic film. *American Optical Co.*

PRODUCTION TIME = CYCLE TIME / 4

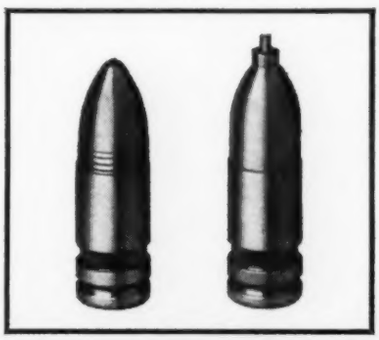
on the Vertical Conomatic

The Vertical Conomatic job shown here consists of a second operation where all four spindles are hopper-fed. A single operator produces 6,500 pieces per eight-hour shift — an average work cycle of 14 seconds—an average part production of 3½ seconds!

Although Vertical Conomatics can produce *4 like parts* during every cycle, they can be used to advantage for producing *dissimilar parts* during each cycle, within certain dimensional limitations.*

It will pay you to investigate the possibilities of the Vertical Conomatic on your own work. Write for details.

*** Consult Cone for particulars.**



CONE
AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

Announcing the

KEARNEY & TRECKER
MILWAUKEE

Model TT Precision Milling and Boring Machine

Scientifically constructed for accurate and convenient operation, the Model TT Precision Milling and Boring Machine enables the operator to mill and bore a workpiece from two sides without changing the setup —an answer to your difficult milling and boring problems that require exceptional precision. Convenient operation is of paramount importance on any machine tool. This machine provides dual table controls on each side of the bed. Each upright is a complete unit in itself with column and spindle controls. A swiveling control pendant provides complete control from the most advantageous operating position at each column.

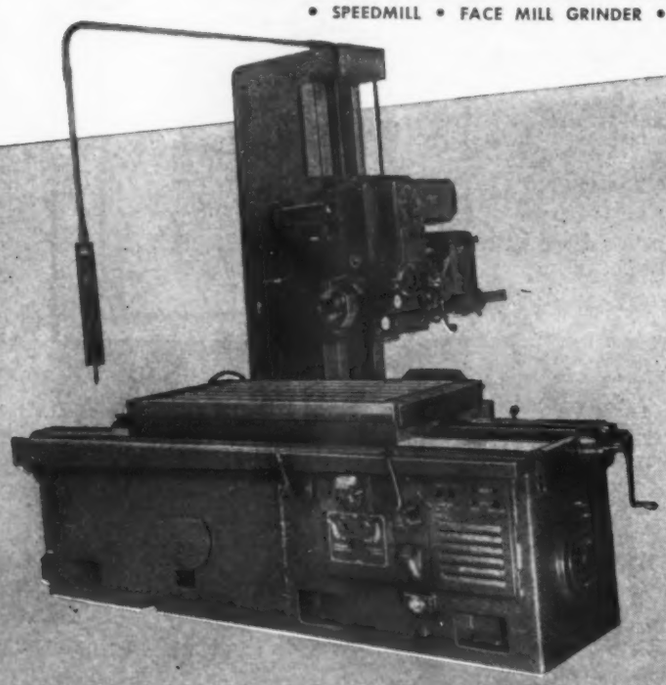
Features of operation and construction that make this machine outstanding in precision operation and versatility are —

- The No. 50 National Standard spindle nose to accommodate modern milling tools.
- Spindle rotation of both spindles in either direction permit the use of right or left hand milling cutters.
- A wide range of speeds and feeds are available for the efficient use of modern cutting tools on a wide variety of operations.
- A thread cutting feature provides boring and thread cutting on two sides of a workpiece in a single setup.

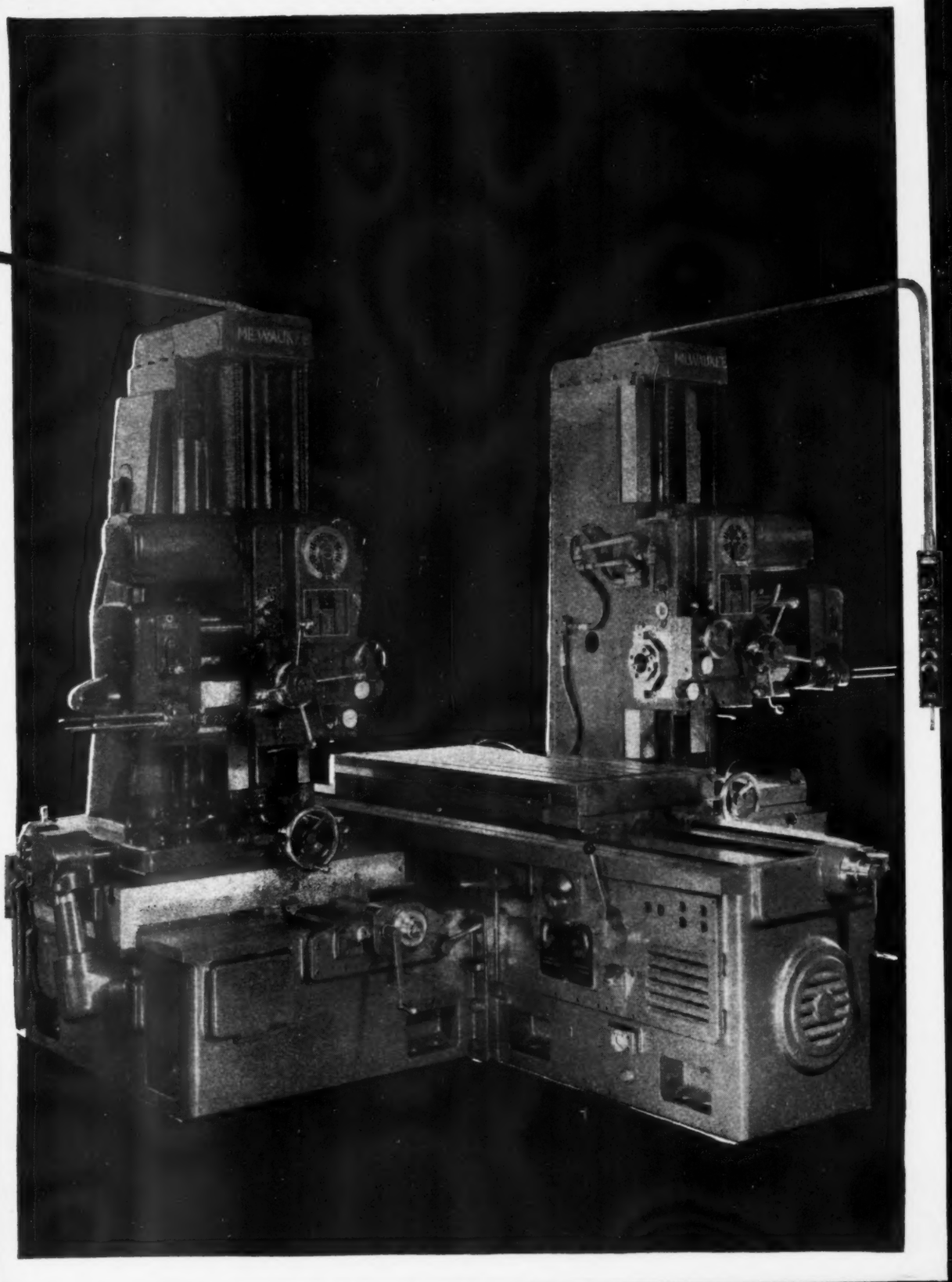
Write for Catalog T11, a complete descriptive catalog on the Model T and the Model TT Precision Milling and Boring Machine.

KEARNEY & TRECKER
Products
CORPORATION
MILWAUKEE 14, WISCONSIN
Subsidiary of Kearney & Trecker Corporation

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC BORING MACHINES.



The Model T Precision Milling and Boring Machine, a single spindle machine, is the companion to the Model TT. It is an ideal machine for precision work in the toolroom where great accuracy is required.



KEARNEY & TRECKER
MILWAUKEE
Precision Milling and Boring Machine
No. 3 MODEL TT

For Maximum Production of High Quality Work

THE BARDONS & OLIVER NO. 7 UNIVERSAL TURRET LATHE IS OUTSTANDING!

Here are a few of many reasons:

The single lever hydraulic speed preselector and hydraulic spindle brake contribute to the long standing and well deserved reputation for ease of operation and sensitiveness of control.

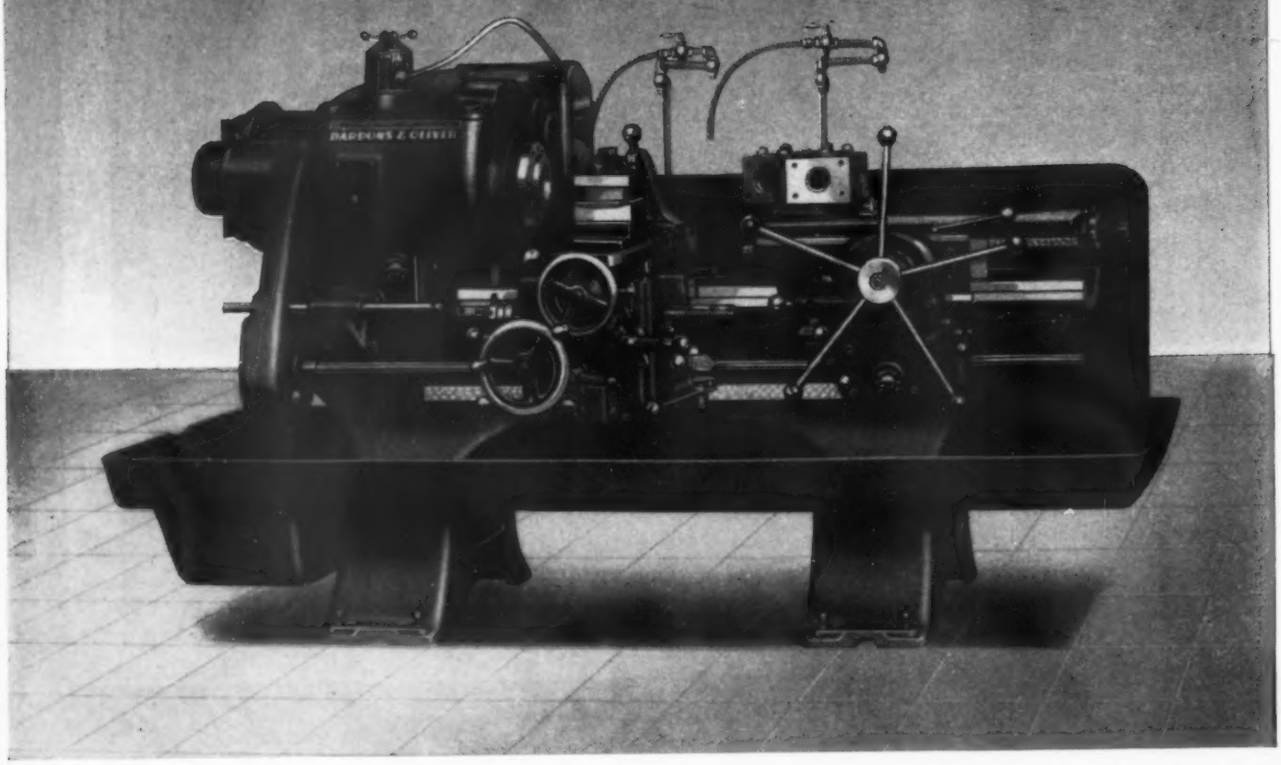
The flange mounted motor with the alloy steel shaved and ground helical gear transmission furnishes ample power and speed for most efficient use of carbide cutting tools.

Solid hardened alloy steel bedways and hardened steel strips on both slide and saddle assures long life to the built in accuracy of the machine.

Write for circulars describing our large line of RAM TYPE and SADDLE TYPE TURRET LATHES.

BARDONS & OLIVER, INC.

1133 West 9th Street • Cleveland, Ohio • U. S. A.



OUT OF BARBARISM WITH MEASURING TOOLS

The earliest measuring tool was the variable human body. Whose body? Before inches and centimeters the units of measurement were the digit, width of finger; the palm, four fingers; the hand, width; the cubit, length from elbow to longest finger tip. A dwarf gained more by measuring with his hand than a butcher does by weighing his.

Science and civilization began when the Egyptians built sundials, and quadrants, and legalized the "base length of the pyramid" as the prime unit of measurement.

How impossible your industry would be today without standards of reference, measuring tools, and machine tools that save almost as much time in automatically measuring as they do in cutting!

Fortunately, incredibly precise inspection gauges for repetitive measuring can be built to check dimensions of any finished part better and faster. Vulcan can find the way to build the special gauges which will save you man-hours, insure quality, and increase your profit.

THE VULCAN TOOL CO.

730 LORAIN AVE.,
DAYTON 10, OHIO

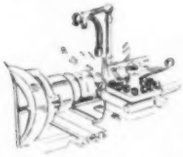
WRITE FOR THIS

ENGINEERING • PROCESSING • DESIGNING • BUILDING
SPECIAL TOOL AND MACHINERY MANUFACTURING

THE GREATEST CUTTING FLUID NEWS IN YEARS!

Now One Coolant Covers 85% Of All METAL-WORKING OPERATIONS

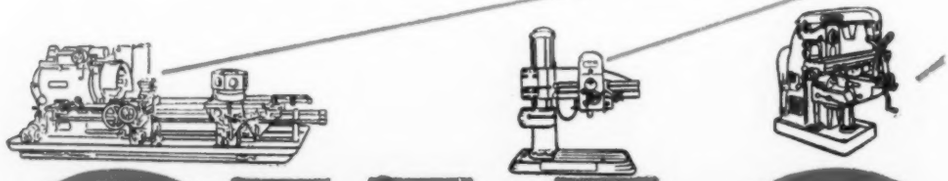
CIMCOOL, developed in the laboratories of the world's largest machine tool builder, strikes a *new high* in production efficiency—a *new low* in unit cutting fluid costs! Through *unique physical and chemical properties,* high cooling capacity and high friction reduction are combined to a degree never before attained! And most important of all, this revolutionary new principle makes CIMCOOL applicable to 85% of all metal-working operations requiring cutting fluids!



A case in point

The Gisholt Machine Company, Madison, Wis., makes a turret lathe drive shaft of SAE-1045 steel, heat treated before machining and running between 197 and 217 Brinell. Shape of the piece makes removal of large quantities of stock necessary. Use of CIMCOOL increased production per tool grind from 12-13 pieces to 22-23 pieces. Tool grind, grade of tool, speed and feeds, machine and operator remained the same. The only difference was the change to CIMCOOL—AND an increase of nearly *100% production per tool grind!*

The Multi-Purpose Cutting Fluid

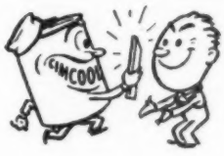


CIMC

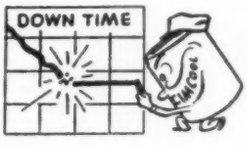
CIMCOOL Provides the Lowest Unit Cutting Fluid Cost!

CIMCOOL helps increase production rates. Increased cooling capacity permits higher cutting speeds and feeds. Grinding wheels cut more freely. Low surface tension allows small chips and grit to settle out rapidly.

CIMCOOL helps increase tool life. Chemical lubricity reduces tool wear. Tools are kept cool to touch, even at higher cutting speeds. Increased wetting action permits greater penetration between tool and chip.



CIMCOOL reduces downtime on machines. Fewer tool changes and fewer changes of cutting fluid are necessary. Pump and supply lines are kept clean, eliminating the need of flushing. No spoilage.



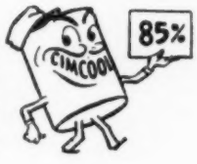
CIMCOOL facilitates accuracy. Freer cutting reduces pressure. Uniform temperature is maintained on work and on machine. Dirt does not stick to work or gages, permitting faster, more accurate gaging.

CIMCOOL is tops with operators. It restricts bacterial growth, does not contain animal or vegetable oils subject to rancidity, and is not a skin irritant. Smoke, objectionable odors and hot chips are eliminated.

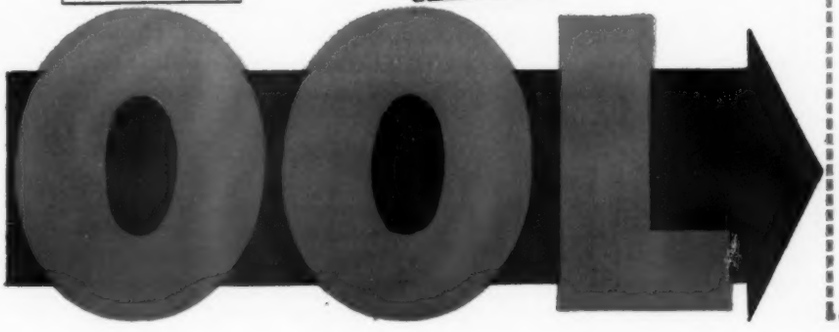
CIMCOOL is safest. Fire hazards are eliminated. Absence of slippery film on operator's hands, machine controls, work and floor reduces danger of accidents. Restriction of bacterial growth limits risk of infection.

CIMCOOL contains a rust inhibitor good for the life of the fluid for protection of machine and work. It does not contain any chromates or highly alkaline components which may be irritating.

CIMCOOL is applicable to 85% of all metal-working operations requiring cutting fluids. It replaces all water emulsions and all but very highly compounded specialty oils for selected jobs.



DIVISION OF
THE CINCINNATI MILLING MACHINE COMPANY
CINCINNATI 9, OHIO, U.S.A.



Manager, CIMCOOL Division
Cincinnati Milling Machine Co.
Cincinnati 9, Ohio, U.S.A. A.M.-2

_____Please send me a copy of "What Is Cimcool?"

_____Please have sales representative call.

Name_____

Company_____

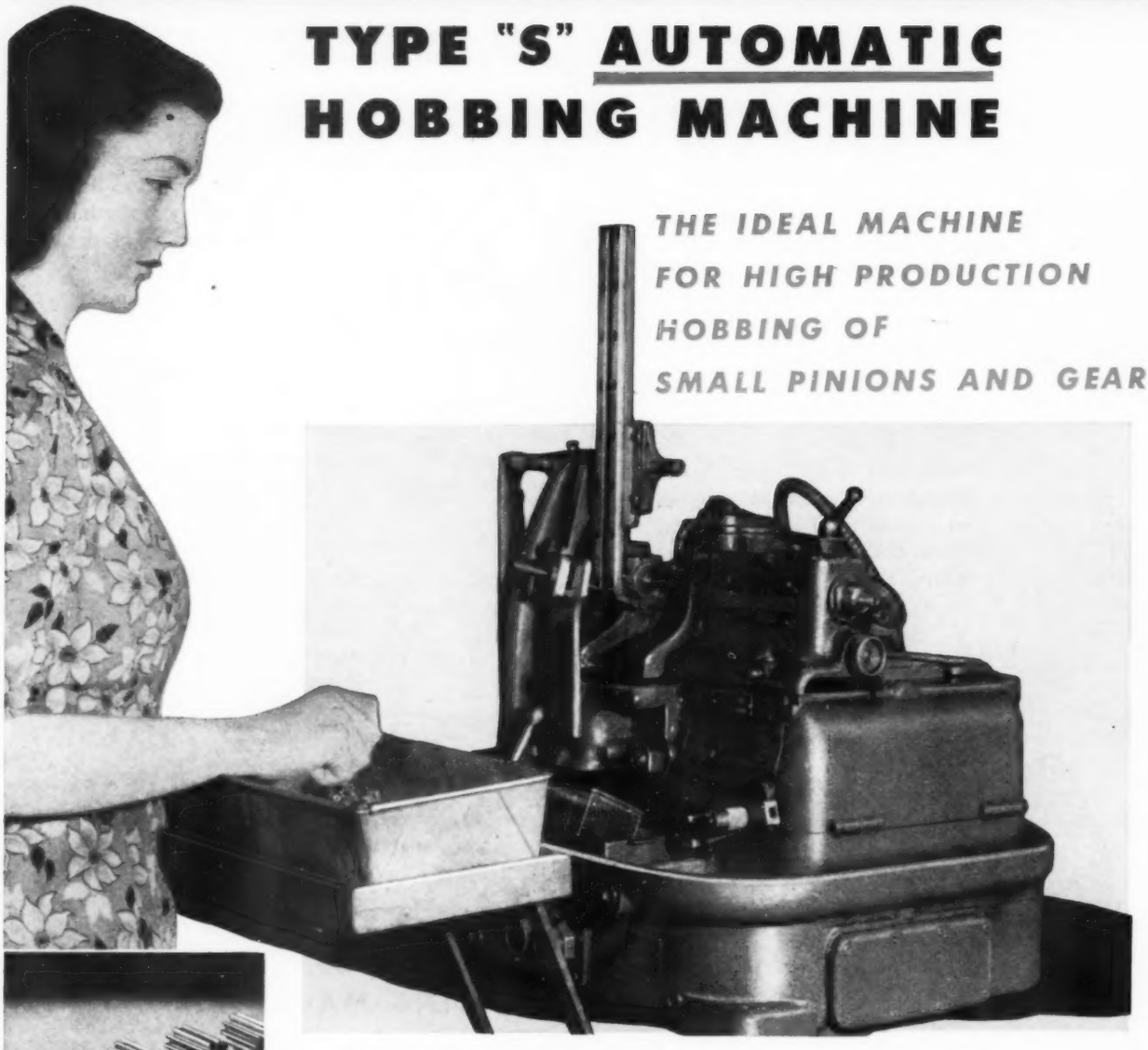
City_____ State_____

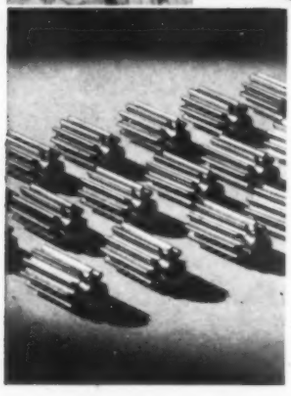
BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

TYPE "S" AUTOMATIC HOBBING MACHINE

THE IDEAL MACHINE FOR HIGH PRODUCTION HOBBING OF SMALL PINIONS AND GEARS





Pinions for clocks, instruments, timers, small speed reducers, light machines, small motors, and many other light-duty mechanisms can be made *fast and accurately* on the Barber-Colman type "S" Automatic Hobbing Machine. For example, the machine shown above is hobbing 10 teeth of 48-pitch clock form on free-turning brass rod blanks .440" long and .249" O.D. at the rate of *240 pieces an hour.* In this customer's plant, 11 Type "S" machines with 12-sec. cycles and 2 with 19-sec. cycles are producing a total of 290,000 pieces every week (working two 8-hour shifts, six days). Write today for our bulletin on the Type "S" Automatic Hobbing Machine and see how it can *improve production and lower costs for you.* Ask for Bulletin F-1474.

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

Needle bars on hosiery knitting machines reciprocate over a complicated figure 8 course . . . and at split-second speeds. Weight of the bars is an important factor, therefore, in the machines' performance. Making them of lightweight Mazlo Magnesium permits increased knitting speeds, more production and superior products.

In tricot knitting machines, Mazlo Magnesium extrusions are being used in seven and fourteen foot lengths for needle, presser, sinker and guide bars, and many other places in the knitting action. Light in weight, vibration is reduced to a minimum . . . higher speeds are attained . . . service life is long.

May we assist you in determining where American Magnesium products can be used to best advantage in your textile equipment. Write Aluminum Company of America, Sales Agent for American Magnesium Products, 1709 Gulf Building, Pittsburgh 19, Penna.

MAGNESIUM MAZLO PRODUCTS

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

In addition to the four continuous longitudinal walls, with cross girts at 12″ intervals on sizes up to 20″ and 24″ intervals on the larger machines, Sidney Lathe beds can be equipped with tool steel ways if desired.

The tool steel ways are ground in place on the machine providing longer life—and dependable accuracy.

This bed design provides three Vees and a flat. The two well proportioned outside Vee Ways take downward thrust and twisting strains and accurately guide the carriage for straight or taper turning and boring.

The end result is greater rigidity—less chance for misalignment and continued accuracy.

Bulletins on all sizes available

OPEN THE DOOR TO NEW MARKETS

"Luster Sealed" aluminum locks . . . a modern mechanism with a modern metal trim. That's the lock recently announced by Schlage Lock Company, San Francisco . . . sure to be popular.

Luster Sealed! It's Alcoa Aluminum with the Alumilite* finish, producing a satin-silver, hard wear-resistant surface that will not tarnish under normal usage. Not a coating, but an integral part of the parent metal. It cannot peel; nor is there lacquer to scratch or wear off.

This is just one of many finishes that can be applied to aluminum to give your products more sales appeal with the practical touch. Mechanical, chemical, electrolytic and electroplated finishes are all possible with Alcoa Aluminum. For data on finishes, consult your near-by Alcoa sales office. Or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Penna.

*Registered trademark

FIRST IN

ALCOA ALUMINUM

A SNYDER "*Special*" FOR A SPECIAL JOB

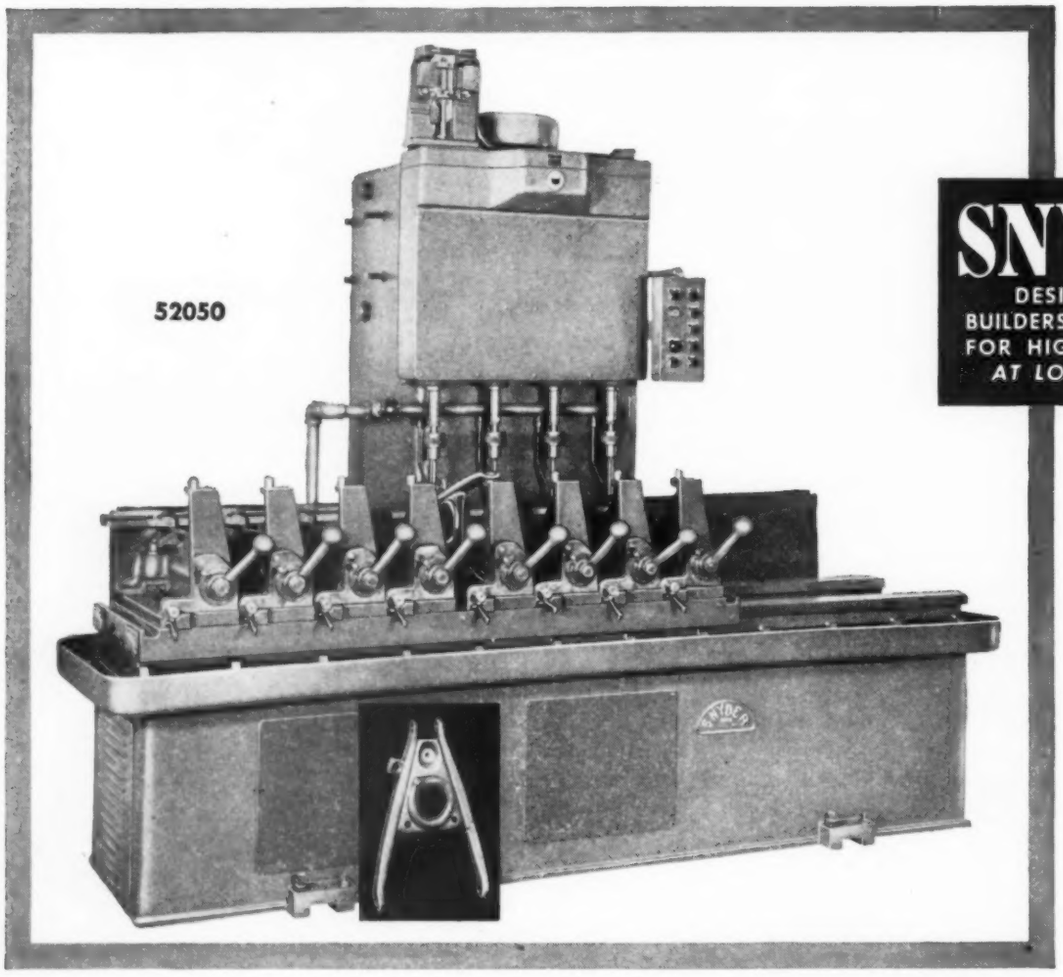
This Snyder four-spindle tapping machine for tapping automotive front wheel support brackets is another example of Snyder's skill in creating special purpose machines that will do the job quickly and accurately, with minimum of operator fatigue and maximum convenience and safety.

The machine has a welded steel column containing the tapping spindle drive motor, leadscrew mechanism and the necessary depth control limit switches.

The fixture table is equipped with eight fixtures, thereby making it possible to work on four parts while four finished parts are unloaded and the fixtures reloaded. The fixtures and the table move hydraulically from the loading to the working positions.

The base of the machine contains the hydraulic equipment for moving the table and fixtures back and forth. The lubricant for the taps is contained in the lower portion of the column.

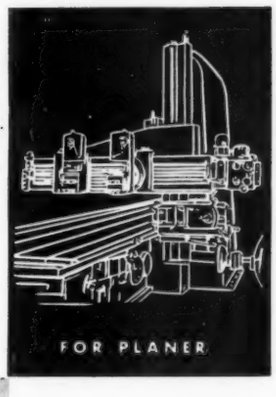
Into every Snyder machine is built the fruits of twenty-one years experience in developing special-purpose machines for specific metal-cutting problems. Possibly there is a place in your production line for a machine that will accomplish definite economies in time, effort, tools and materials. We invite your inquiries. *Snyder Tool & Engineering Company, 3400 E. Lafayette Detroit 7, Michigan.*



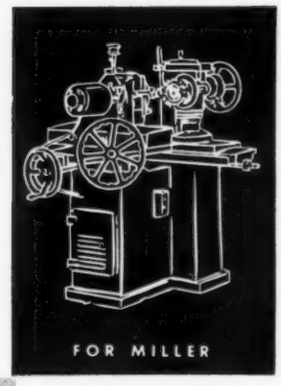
SNYDER

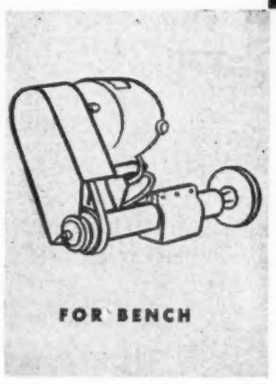
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

21 Years of Successful Cooperation with Leading American Industries



On Again!





Off Again!

Finnegan!

Every Plant Has 100 Jobs For This Portable Tool Post Grinder . . .

★ *Rigid 1-Piece Frame*

★ *6,000 to 13,000 R.P.M. Spindle Speeds*

★ *For internal, external and face grinding*

. . . for it may be used efficiently and effectively on the bench, or on a lathe, shaper, planer, or miller —and it can do a multitude of jobs on each and do them fast and accurately. You get the equivalent of two different length quills at no extra cost because of the exclusive Lempco base construction which enables both the motor and the grinding quill to be adjusted 2" in or out. Available in a handy fitted chest that is easy to carry.

CEILING-PRICED—GOOD DELIVERY

WRITE FOR CATALOG

LEMPCO

5711 DUNHAM ROAD, BEDFORD, OHIO, U. S. A.

KING *Vertical Boring and Turning Machines for* SPEED—ACCURACY—ECONOMY

One of the natural advantages of the King Vertical Boring and Turning Machine is combining operations such as boring and turning so as to complete the work faster.

For example on the flywheel shown the hub boring and outside diameter turning operations are performed simultaneously.

The rigid construction of the machine amply powered to meet exacting requirements assures smooth finish and dependable accuracy. For precision boring, turning and facing operations put your next job on a King Vertical Boring and Turning Machine.

★

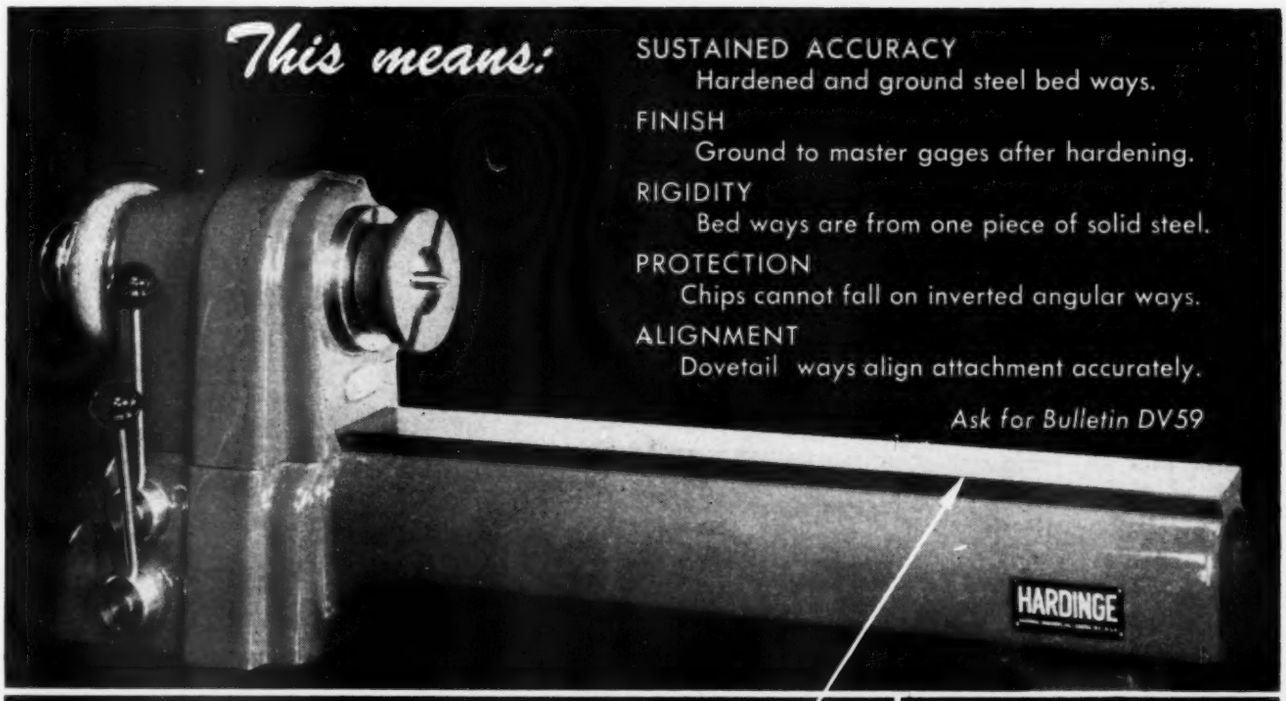
KING BUILDS
Vertical Boring and Turning Machines exclusively — single column types from 30" to 42" and double column types from 52" to 12 feet.

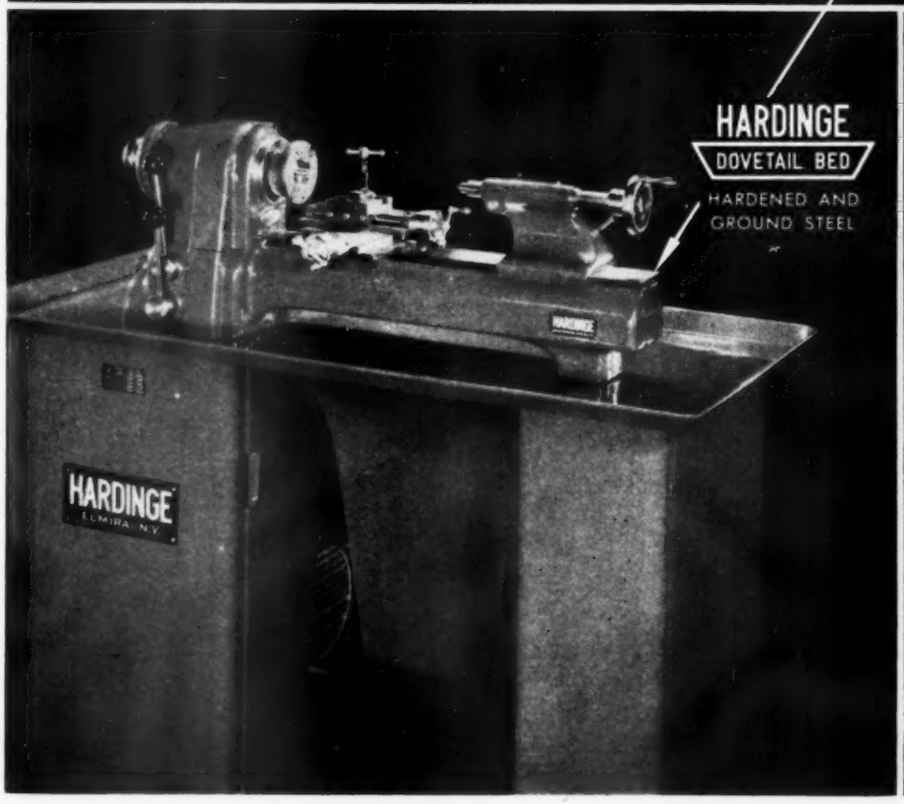
THE KING MACHINE TOOL COMPANY
CINCINNATI 32, OHIO

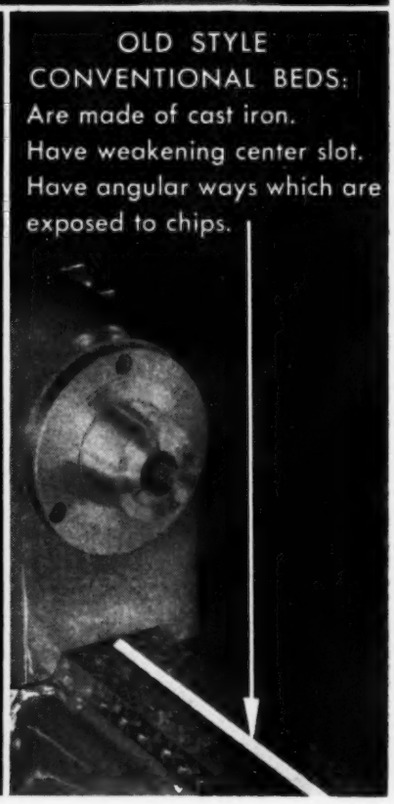
BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

The HARDINGE ELMIRA, N.Y. DV59 Precision Lathe

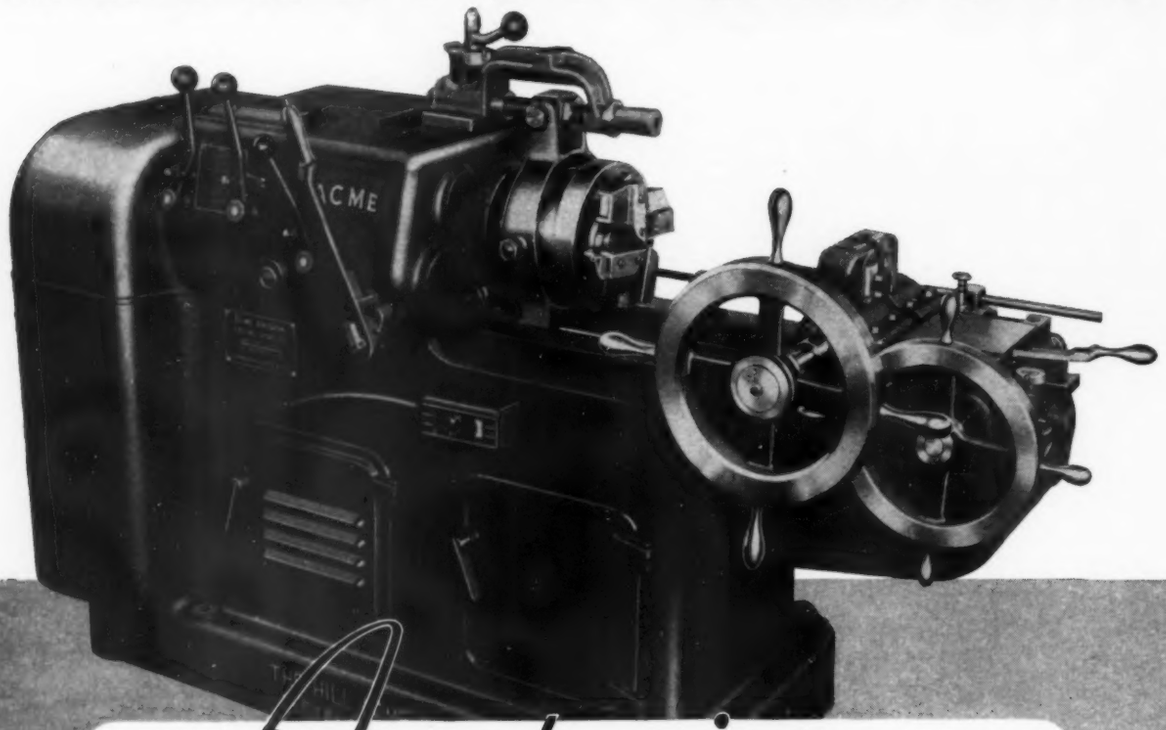
is the only precision lathe with Hardened and Ground Steel Dovetail Bed Ways






OLD STYLE CONVENTIONAL BEDS:
Are made of cast iron.
Have weakening center slot.
Have angular ways which are exposed to chips.

The ACME XL THREADING MACHINE



featuring

1 MICROMETER ADJUSTMENT for controlling diameters while head is rotating.

2 ACME TANGENT DIE HEAD. All wearing surfaces are accurately ground providing long wear and outstanding precision performance.

3 ALL-GEARED DRIVE with eight speed, self contained quick change, selective gear train.

4 ACCESSIBLE CONTROLS for ease and speed of operation insuring increased production.

5 ACME XL THREADING MACHINES are built in single and double spindle types in sizes ranging from 1" to 3" inclusive.

BULLETIN XL-12 GIVES COMPLETE DATA

THE HILL ACME COMPANY

ACME MACHINERY DIVISION

Established 1862

FORGING · THREADING · TAPPING · BOLT · NUT · RIVET MACHINES

4535 ST. CLAIR AVENUE

Cleveland 14, Ohio

MORE ADAPTABLE!

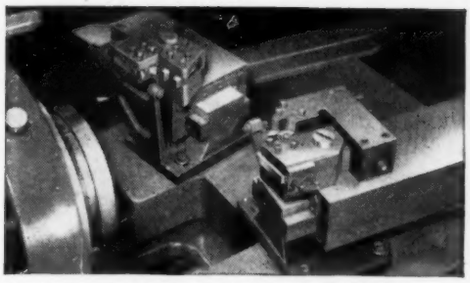
THE GISHOLT SIMPLIMATIC

It's the simple basic design of the Simplimatic that makes it so extremely adaptable—so readily individualized to solve a variety of machining problems. And in every case, it gives you the high speed production and lower cost of an automatic lathe designed solely for the job at hand. A few of its possibilities are illustrated herewith.

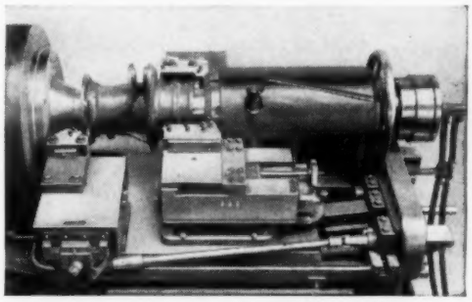
Simpler tooling, easier operation, low cost production commend the Simplimatic wherever you have parts to produce in large volume. It can solve your problem as it has hundreds of others. Write for full information.

GISHOLT MACHINE COMPANY
1201 East Washington Ave. • Madison 3, Wisconsin

Look Ahead...Keep Ahead...With Gisholt Improvements in Metal Turning

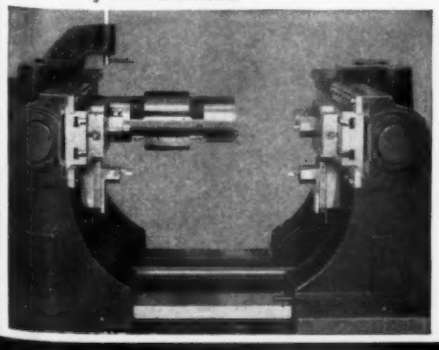


A VARIETY OF SLIDE POSITIONS is permitted by the large area of the platen table. Angular feeds are no problem. Compound slides are unnecessary.

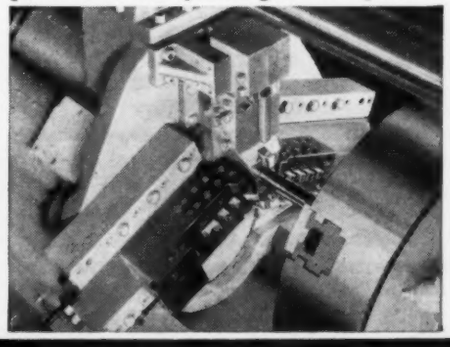


TAILSTOCKS can be mounted on platen table for between-centers work; can be operated by hand or pneumatically.

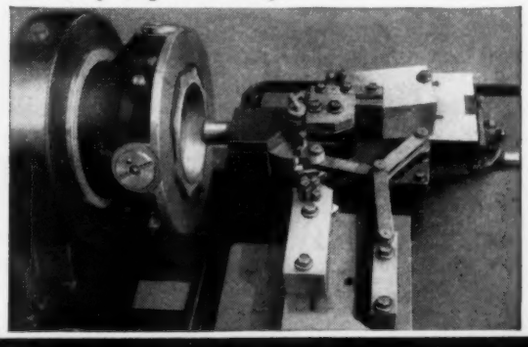
SIMULTANEOUS DOUBLE END MACHINING is possible with full utilization of base machine.



VERTICAL HEAD. Tool slides can also be mounted on a vertical instead of a horizontal platen. A choice of arrangements is possible.



A LINKAGE ARRANGEMENT between the slides can be used for spherical boring in conjunction with facing and turning.



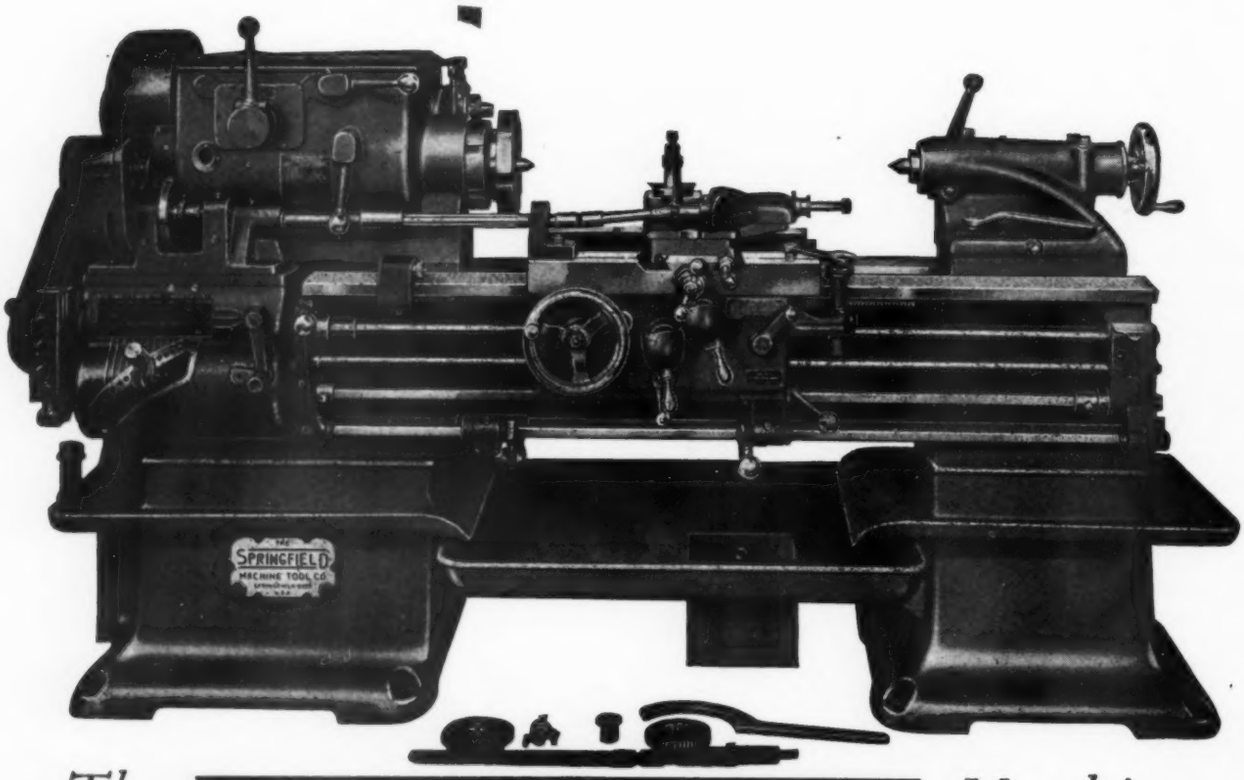
TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Choose SPRINGFIELD GEARED HEAD LATHES

"from the ground up" a superior lathe!

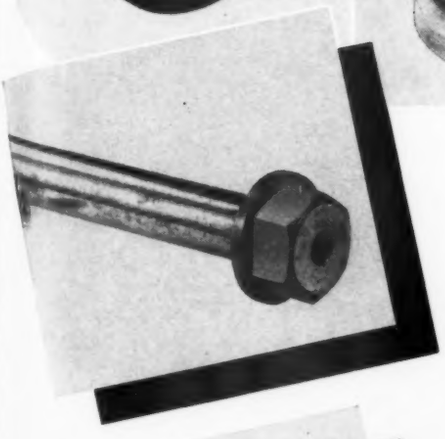
All heavy castings in SPRINGFIELD Lathes, including the bed, are cast in our own foundry. Gearing is carefully engineered to deliver maximum efficiency for years. Attachments, many of which we feel demonstrate unusual engineering ingenuity, are designed for practical usefulness. Lubricating and power transmission systems are rugged, trouble-free. Check the records of SPRINGFIELD Lathes in other shops—then judge their capabilities and quality for yourself.

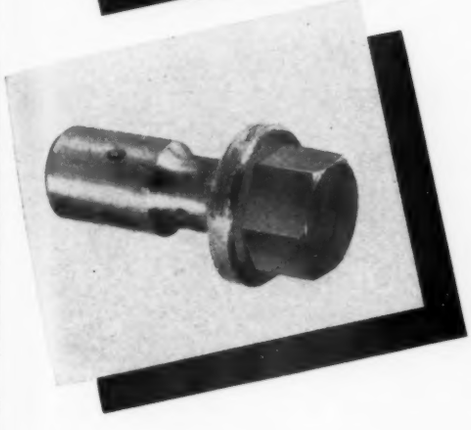
Get complete information—write for our new bulletins.
SPRINGFIELD MACHINE TOOL COMPANY, Springfield, Ohio



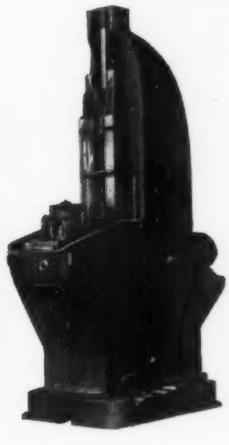
The Tool SPRINGFIELD *Machine Company*

HIGHER production with *Indexing fixtures*





THE keen competition in forthcoming days will require the highest production possible thru surface broaching. Many parts formerly made by other methods are now being surface broached on Footburt machines at great savings in time and money. These few samples of surface broaching are representative of the many types of parts that are being successfully machined. Send your blueprints with production requirements for an analysis of your machining problem.



THE FOOTE-BURT COMPANY
CLEVELAND 8, OHIO
Detroit Office: General Motors Building

Footburt Patented Tooth Form

FOOTBURT *Surface Broaching*

30-40% Longer Life in Pratt & Whitney Taps!

. . . proved by Thompson Aircraft Products Company of Cleveland, Ohio

Lower cost per tapped hole, trouble-free production, and 30-40% longer life with P&W taps than in any others they have used, according to the Thompson Company.

30 blind holes .390″ deep in these hydraulic couplings are being tapped to a class 3 fit at the Thompson Aircraft Products Company. Tap used is a Pratt & Whitney 3-Fluted 8-32 NC Plug Machine Screw Tap of High Speed Steel with Precision Ground Thread.

There is one unassailable proof of a product's quality — that is its record in actual use.

It is an unswerving Pratt & Whitney policy to spare no expense or effort to *guarantee* that every single tap shipped to a customer is the finest that can be made. Expert designing, highest grade steel, scientific heat treatment, and precision craftsmanship — all combine to give Pratt & Whitney taps their well-deserved record of top production efficiency. A listing of our complete tap sizes and styles will be supplied upon request.

PRATT & WHITNEY

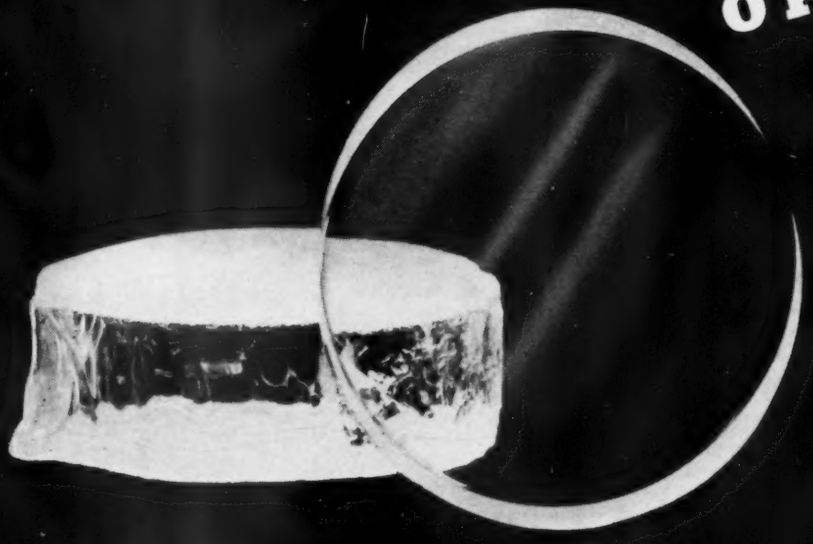
Division Niles-Bement-Pond Company

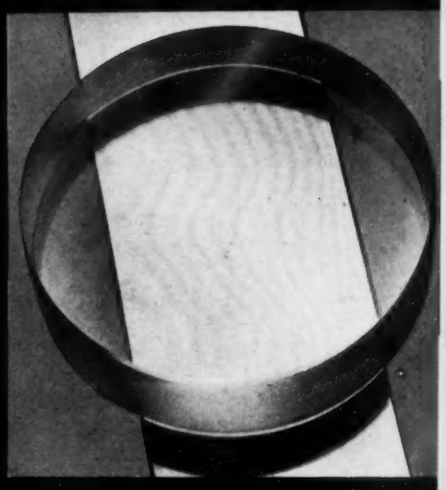
WEST HARTFORD 1, CONNECTICUT

Ultimate Accuracy
IN PRECISION CHECKING OF GAGES AND LAPPED PARTS
assured by

Van Keuren

FUSED QUARTZ OPTICAL FLATS



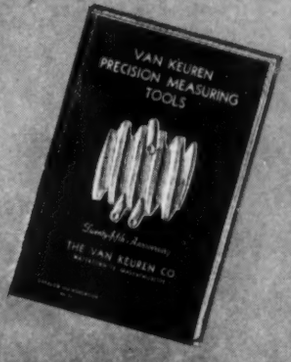


The use of optical flats for precision measurements with light waves was pioneered by The Van Keuren Co. in 1920. The new Van Keuren double surface, pure fused-quartz flats are the result of 25 years of experience. The accuracy and workmanship is superlative.

Fused quartz is highly transparent and has exceptional wearing qualities. The expansion and contraction due to temperature change is 1/16 that of plate glass and 1/6 that of pyrex.

Specify Van Keuren double surface, fused-quartz optical flats for checking flatness of precision lapped parts, maintenance of amplifying gages, and control of gage block wear. They are the most economical to purchase and the most accurate to use.

Worn spot .000023" deep revealed on amplifying gage anvil by means of a Van Keuren optical flat.

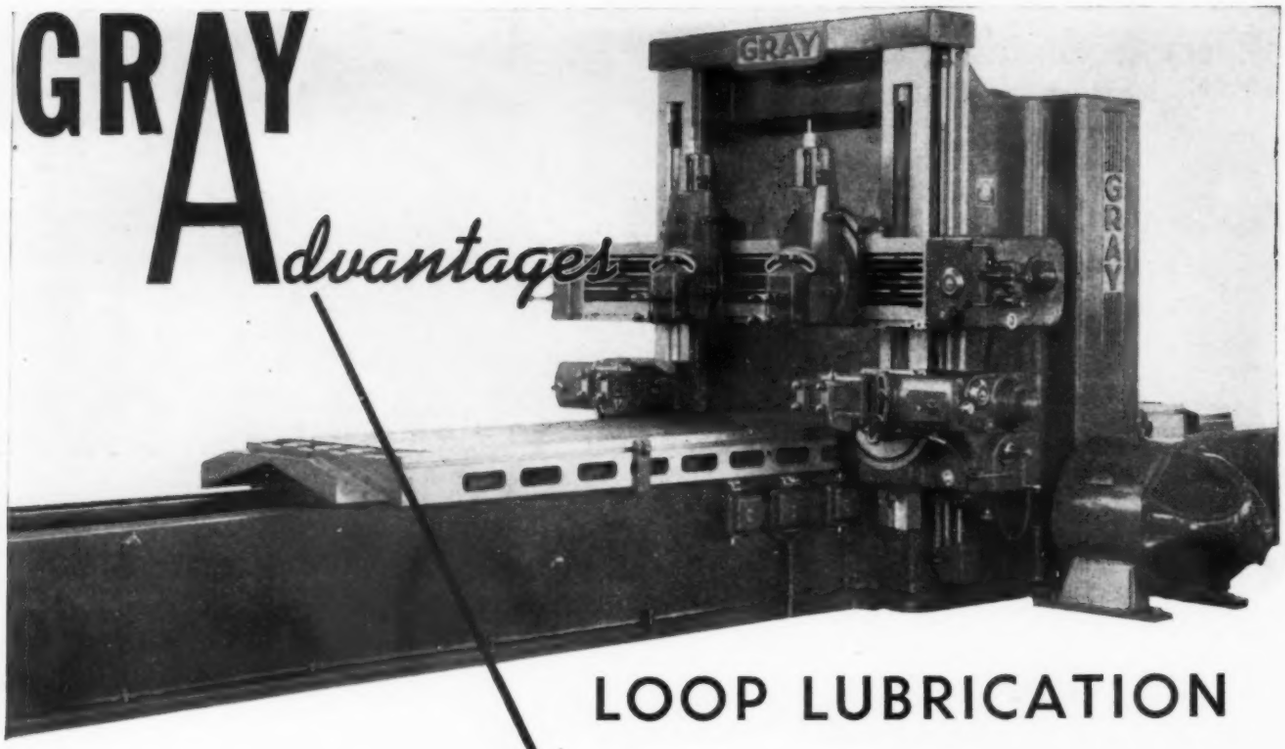


Consult the 160-page Van Keuren Catalog No. 33 for further details. Send for your copy which also contains complete tables, data and formulas for measuring threads, gears, gages and precision parts.

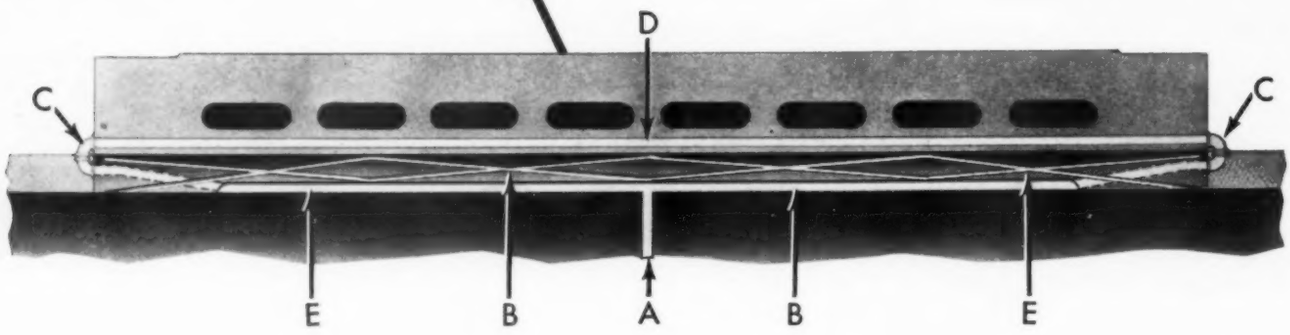
Van Keuren

27th YEAR

GRAY Advantages



LOOP LUBRICATION

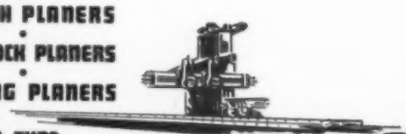


This patented feature is designed to meet the requirements imposed by the high speed and quick reversals made feasible by the new variable voltage drives. Oil under 4½ lbs. pressure enters the system at "A", flows into channel "B", through cross headers "C", into connecting pipe "D", forming a continuous loop. This loop being continuous maintains constant oil pressure throughout the table length irrespective of the table's position on the bed, and also irrespective of the speed of the table or resistance of the ways to the flow of oil from triangular channel "B". Diagonal grooves "E" distribute oil over all parts of the ways. Note entire absence of oil pockets or grooves in the vees of the bed.

Write for special Lubrication Bulletin.

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS

PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

CINCINNATI 7, OHIO, U. S. A.

Sold in Canada by Upton, Bradeen and James Ltd.

Sold in Latin America by Machine Affiliates.

A Dependable Working Partner

**BETTS 100"
BORING AND
TURNING MILL**

For full details
send for
Bulletin No. 2128

Among Heavy Machine
Tools built by
Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER
SPECIAL MACHINES

**BETTS BORING AND TURNING MILLS
are built from 100" up to any requirement**

As in all Betts machines, the accumulated experience of more than three-quarters of a century is built into this general purpose boring mill . . . another striking example of Consolidated's ability to combine accuracy and power with maximum productiveness.

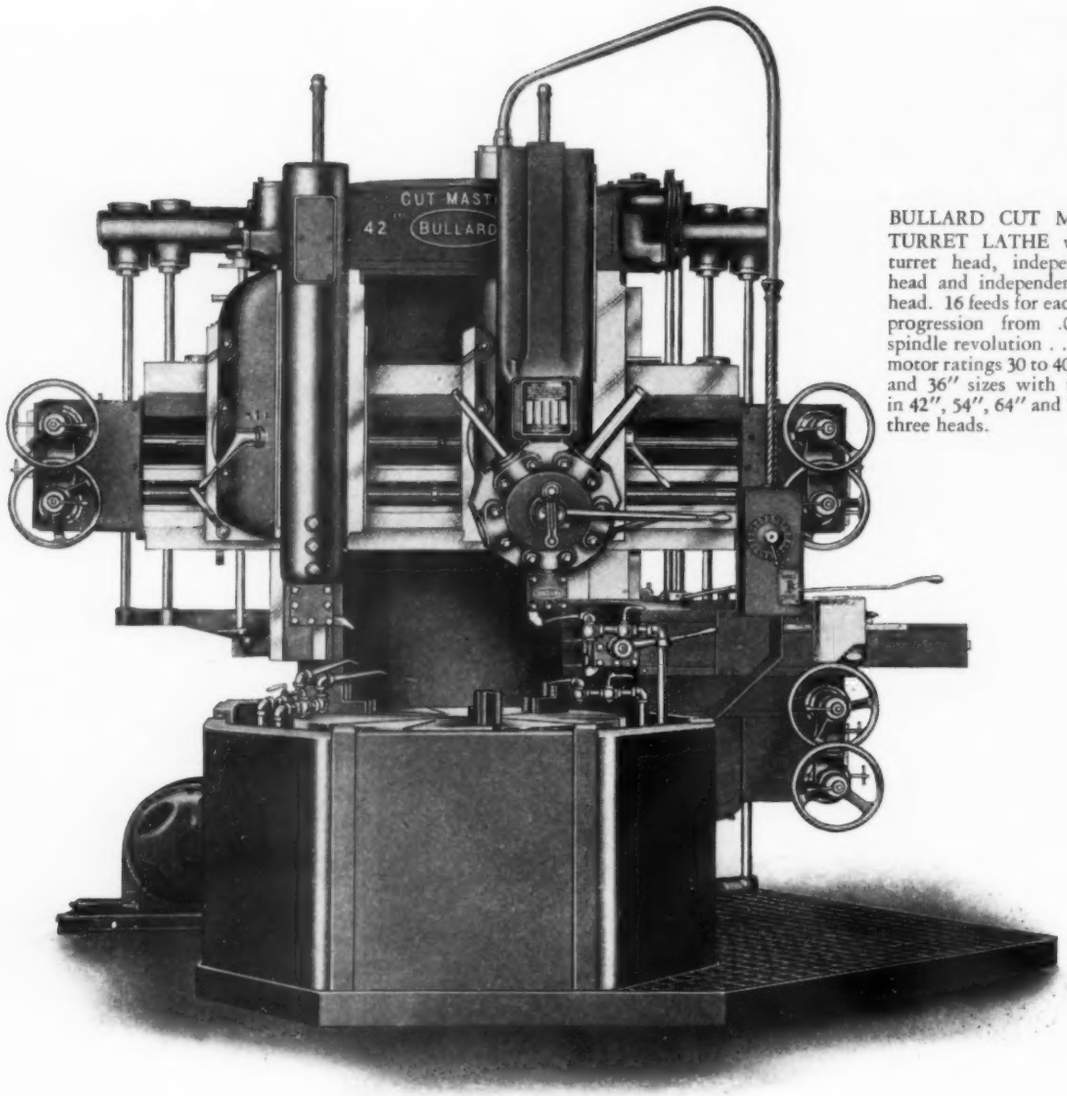
BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1861

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK



BULLARD CUT MASTER VERTICAL TURRET LATHE with swiveling main turret head, independent left-hand ram head and independent non-swiveling side head. 16 feeds for each head in geometrical progression from .0026" to .500" per spindle revolution . . . 20 table speeds . . . motor ratings 30 to 40 hp. Available in 30" and 36" sizes with two heads only . . . in 42", 54", 64" and 74" sizes with two or three heads.

UNIT PRODUCTION COSTS ARE LOWER

when you cut machining time both ways

1. CUT TIME ON CUTS

Bullard Cut Master Vertical Turret Lathes remove more metal in less time than any other machines of the same type because they offer the best combination of rigidity, freedom from vibration, smooth flow of power and wide range of speeds and feeds. That's why they permit you to take full advantage of the latest developments in cutting tools for heavy, accurate cutting.

2. CUT TIME *BETWEEN* CUTS

Bullard Cut Masters keep lost time between cuts at the minimum because of fast chucking — two or three heads working simultaneously — independent rapid power traverse of each head in any direction which brings tools quickly to within a fraction of an inch of the work — quick and easy engagement of proper feed and convenient location of all operating controls.

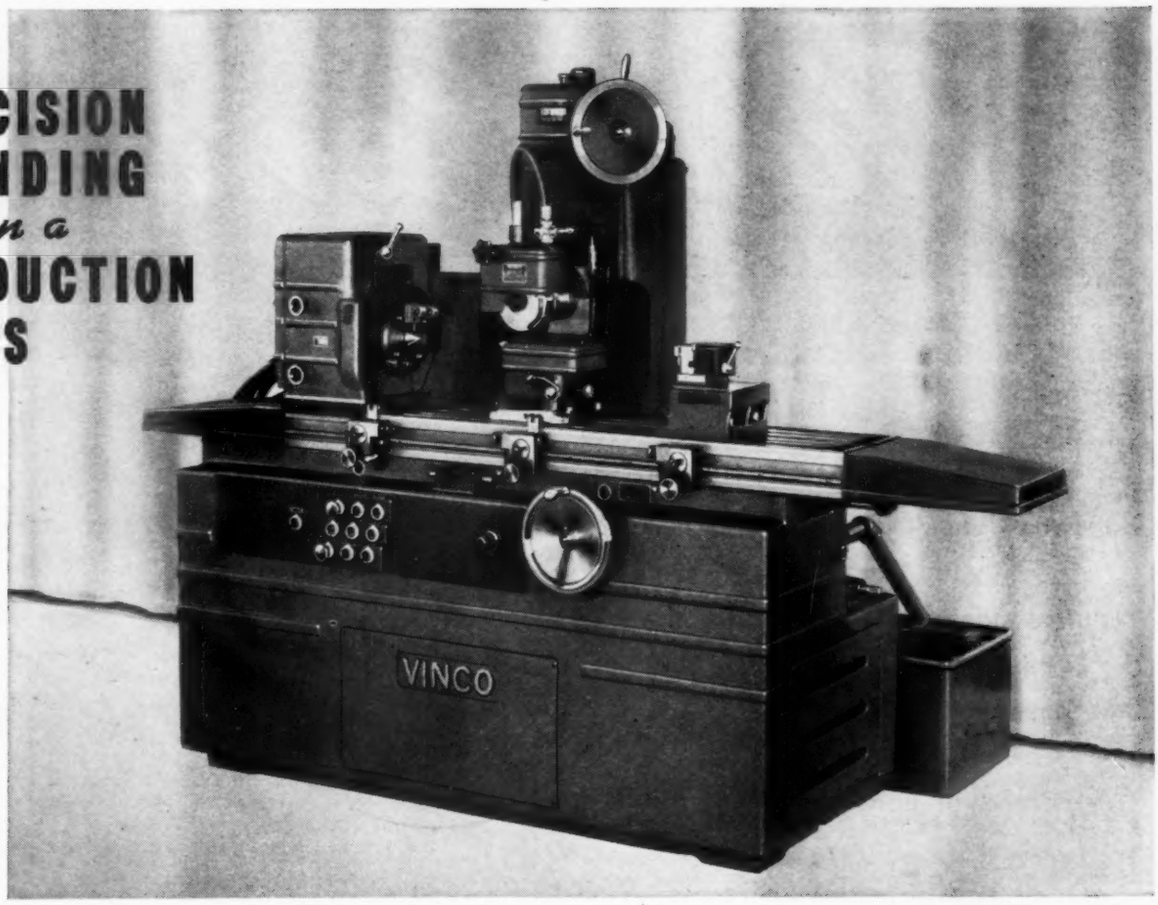
For further reasons why Bullard Cut Masters give peak production by *cutting time on and between cuts*, write for your free copy of Bulletin CVTL-4-1-46, today. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD

CREATES *NEW METHODS*

TO MAKE MACHINES DO MORE

PRECISION GRINDING *on a* PRODUCTION BASIS



Vitally Important to Modern Gear and Spline Assemblies.

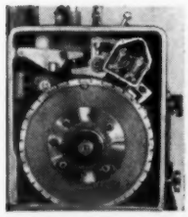
Grinding these related toothed parts to extremely close tolerances is a production problem of deep concern to the gear and spline industry.

The VINCO Semi-automatic Spline and Gear Grinder has solved this problem on every count, according to enthusiastic reports received from its users. Unsolicited verification of its adaptability and precise performance under actual working conditions is welcome news that merits the attention of everyone concerned with gear and spline production.

Seeing this grinder in operation is conclusive proof of its important bearing on future spline and gear production. Drop in at VINCO and thoroughly investigate every feature and detail of its construction. See its smooth, silent operation and unerring accuracy, then judge for yourself whether it deserves a place in your production plans.

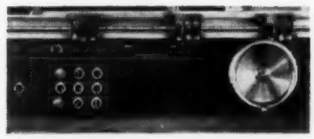
VINCO

This is the only way to prove what we and our spline and gear grinder customers already know; that the VINCO Semi-automatic Spline and Gear Grinder is a definite need in the production of precision gear and splined parts.



The Index Head

Guaranteed that spacing error of notches in plate will not exceed .0003″ between any two notches



The Control Panel

Simplicity of control makes it possible for any semi-skilled operator to get top production with little training.

MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

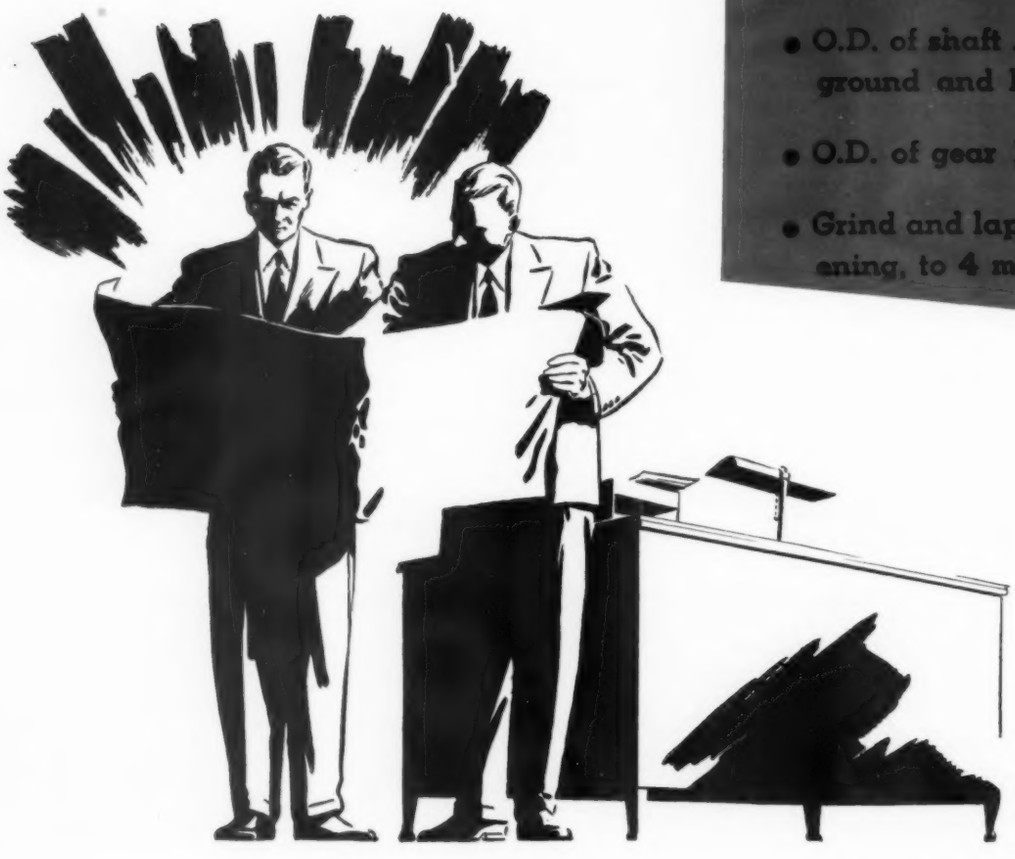
Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Plain Cylindrical Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.

They Came to

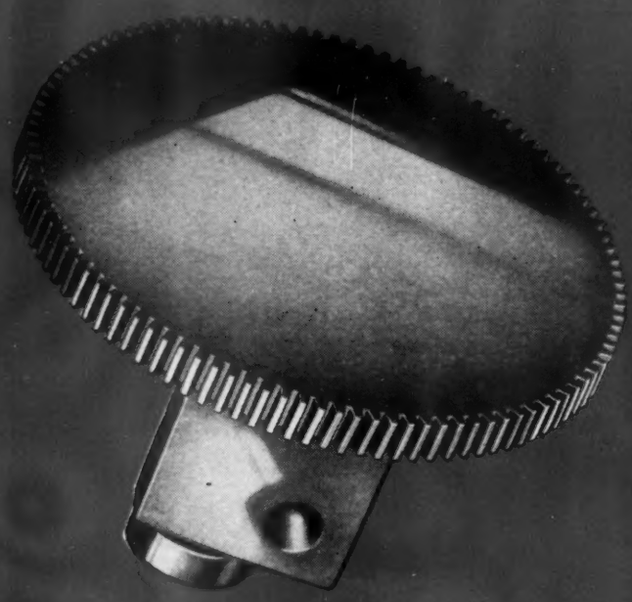
With problems that had to be whipped— problems with neither formula nor precedent as a guide to their solution. That we did whip them is water over the dam, and, if they didn't have an important bearing on future precision products, we would never mention them. Take for instance the specifications for this variable speed drive disk, shown here, as one example of precision production.

Specifications

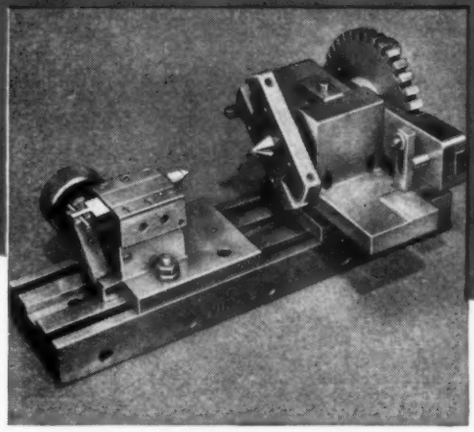
- 14½° pressure angle, spur gear
- 106 teeth—64 D. P.
- pitch dia. 1.6562″ $^{+.0}_{-.0005}$″
- root dia. 1.620″
- tooth thickness .0245″
- P. D. and O. D. concentric with .2498″ diameter shaft within .0005″ total indicator reading.
- O.D. of shaft .2498″ $^{+.0}_{-.0002}$″ ground and lapped
- O.D. of gear 1.6875″ $^{+.0}_{-.001}$″
- Grind and lap face, after hardening, to 4 micro inches.



VINCO

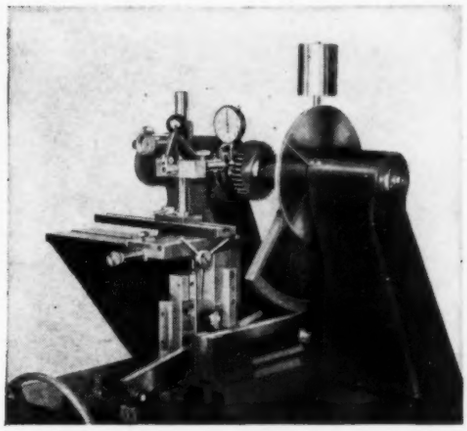


We were able to hold all specified tolerances and produce these parts in quantity by using the VINCO Spline and Gear Grinder, the VINCO Involute Checker and VINCO Precision Centers. These outstanding pieces of equipment are available to you who face production and inspection problems of a similar nature. For further details concerning these machines write VINCO or call in one of our Sales Engineers. Sales offices are located in New York City, Cleveland and Chicago.



VINCO GRINDING CENTERS AND INDEX PLATE

For use on surface grinders. Job capacity up to 4" dia. Hardened, ground steel base. Headstock with spindle. Tailstock has retractable center. Spindle may have work driver or face plate together with index plate or crank.



THE VINCO INVOLUTE CHECKER

Made with ten or twenty inch base circle disk. Checks gears or splines of any pressure angle, pitch or degree of involute roll. Four models with special applications completely cover individual needs. Tell us your requirements.

LOCK JAW *Stops*

SLIDING

HEAVING

SHIMMYING

CHATTERING

YAWING

BUCKLING

HANDY *New All-Purpose* CLAMP

Eliminates expensive clamping and bolting operations. No more hunting around the shop for straps, bolts, washers, nuts or scrap pieces to wedge or lock your work in position. No oddly and awkwardly contrived, odd-sized and makeshift locks, limited in their ability to wedge and hold.

Now LOCKJAW gives you positive, powerful two-way locking, sure grip pressure downwards and side-ways. It may be set at any angle on the table and held by the T-slot bolt. Then LOCKJAW pressure is applied to one or more pieces of stock by simply adjusting Capstan Jack Screw.

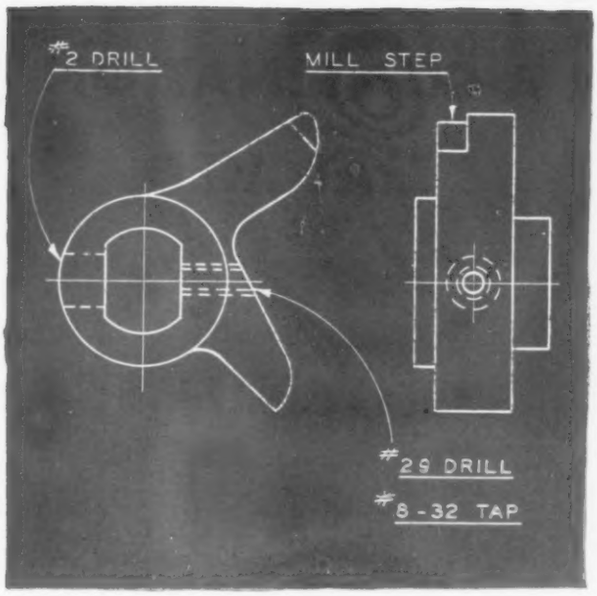
Setting up or taking down is a quick and simple operation. Every machine shop, tool room, or metal working unit can find many handy uses for this new Rivett conceived clamp on their planers, radial drills, shapers, milling machines, surface grinders and boring mills.

You, too, will save time, trouble and inconvenience when you use LOCKJAW to eliminate cumbersome and awkward clamping.

RIVETT

RIVETT LATHE & GRINDER, Inc.

BRIGHTON • BOSTON • MASS. • U. S. A.



THIS IS A FLEXIMATIC AUTOMOTIVE JOB!

FLEXIMATIC

by KINGSBURY

Flexible, Automatic, and Fast . . . !

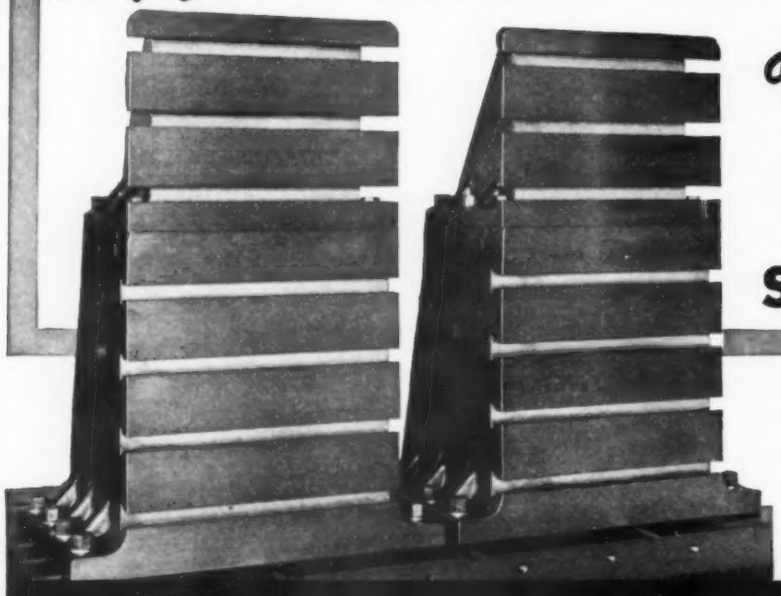
Even such a small part as an automobile door latch presents an opportunity for savings when a Kingsbury FLEXIMATIC is used to produce them. The machine illustrated performs four operations—drilling two holes, tapping and milling—finishing these brass forgings at unbelievably high speeds. And, in adding to the ease and economy of FLEXIMATIC operation is the fact that this machine doesn't even have to be unloaded! The operator merely loads the work and clamps it. It is automatically unclamped and ejected.

Kingsbury FLEXIMATICS are made up of standard units for drilling, milling, tapping, etc. — as many as necessary — mounted in any position on one of several types of standard bases. This Kingsbury method of standardizing the various units of assembly results in a machine that can easily be changed to meet changes in design and production . . . a FLEXIBLE, an AUTOMATIC, a FAST production machine.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

A *New* HIGH IN A COMBINATION of MATCHED *Angle* STRUCTURES!

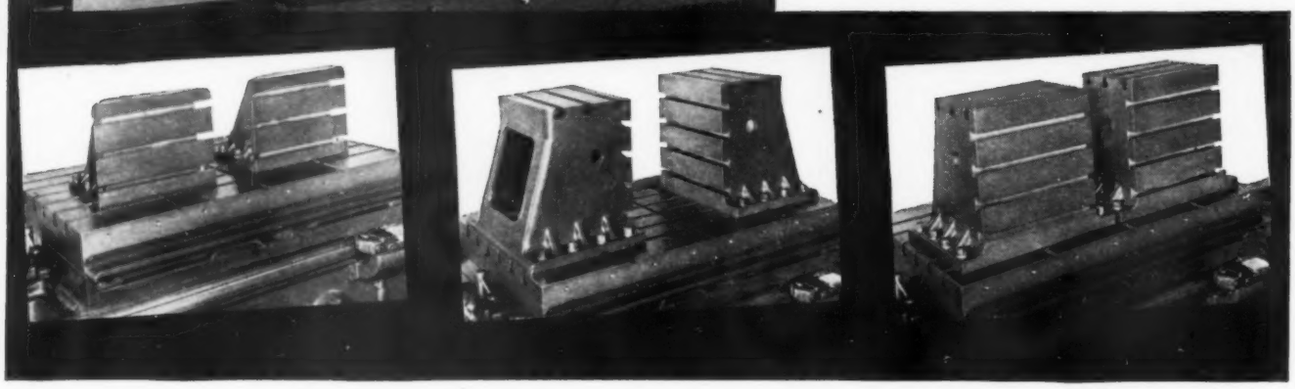


TOP MEMBERS—Vertical Face—12" High, 16" Wide—3 Tee Slots.

BOTTOM MEMBERS—Vertical Face—18¼" High, 16" Wide—4 Tee Slots.

TOP FACE—12" Deep, 16" Wide—3 Tee Slots.

TEE SLOTS—13/16" Wide, 4" Centers.



THIS combination of matched units serves convenience and rigidity for accurately locating and chucking work when boring, milling, planing or for other toolroom and general use. They can be used singly or in variety of combinations for large or small work.

They are machined from box section castings, with Tee slots and flat surfaces in precise alignment.

They are made with the same tooling and quality as the JIGMIL table.

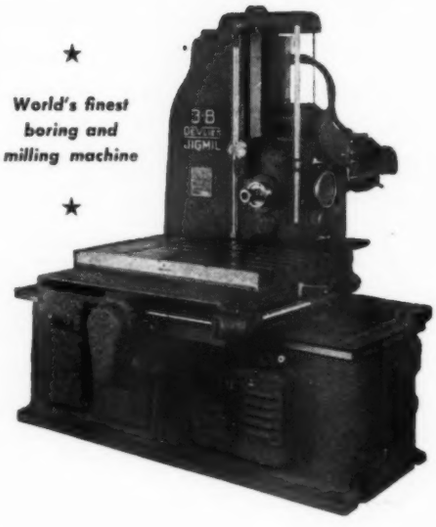
Each set includes Tee slot nuts, studs and screws.

Write for price and delivery!

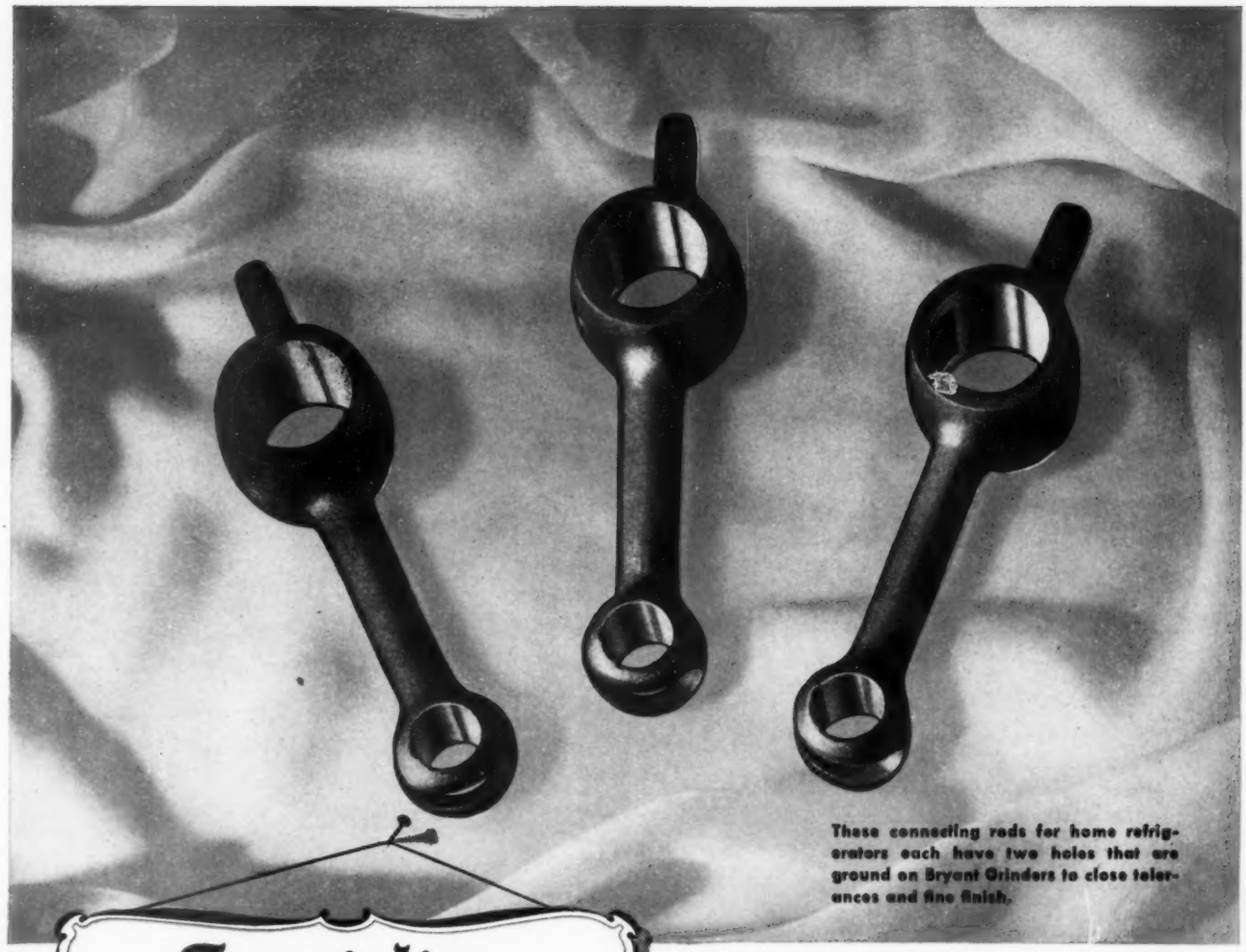
★

World's finest boring and milling machine

★



DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**



These connecting rods for home refrigerators each have two holes that are ground on Bryant Grinders to close tolerances and fine finish.

Specialists in Forged Steel Jewelry

No, we don't sell it; we don't make it, but we do build internal grinding machines that make it. The three connecting rods for home refrigerators, shown above, are typical examples of the type of work that is ground on Bryant Internal Grinders. They are truly jewel-like in their finish, but that is not enough—to be sure, Bryant Grinders produce metal parts that have surfaces finished correctly to millionths of an inch, when desired, but Bryant machines also produce these same parts with holes that are truly round and straight. These are basic elements that Bryant insists upon to assure Bryant users that their parts and products will last for years without mechanical failure.

WE KNOW YOUR PROBLEM IS DIFFERENT . . .

. . . practically every internal grinding problem is different. But when you require extreme accuracy or high production, or both, your first step should be to study your problem with a man who makes it his business to solve them. Your first step should be to—

Send for the Man from Bryant!

BRYANT

BRYANT CHUCKING GRINDER CO.

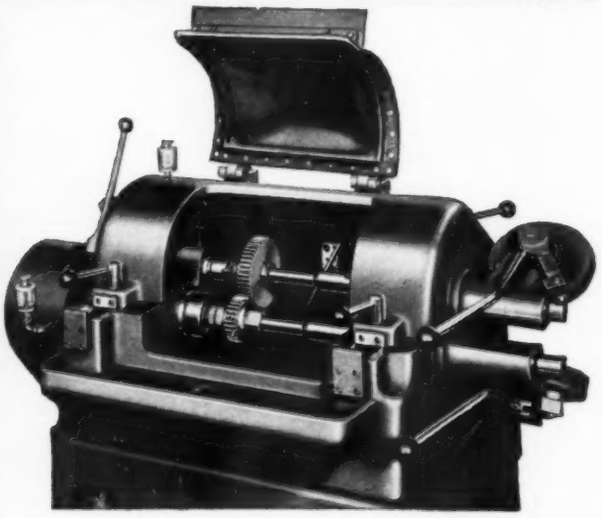
SPRINGFIELD, VERMONT, U. S. A.

Don't Let NOISY GEARS Reach Assembly

There is no excuse for incorporating noisy gears in any assembly where gear noise cannot be tolerated. Find out before those gears reach assembly whether or not they are noisy and avoid the necessity of tearing down the assembly in order to replace them with quiet gears.

That is precisely the function of The Red Ring Gear Sound Tester. It will always spot noisy gears. Furthermore, it will indicate the nature of the trouble which causes the noise so that it can be corrected.

The acoustical horn of this machine amplifies gear noise 50 times. Center distance between gears in the sound chamber may readily be set with precision gage blocks. Gears may be tested either with or without brake load.

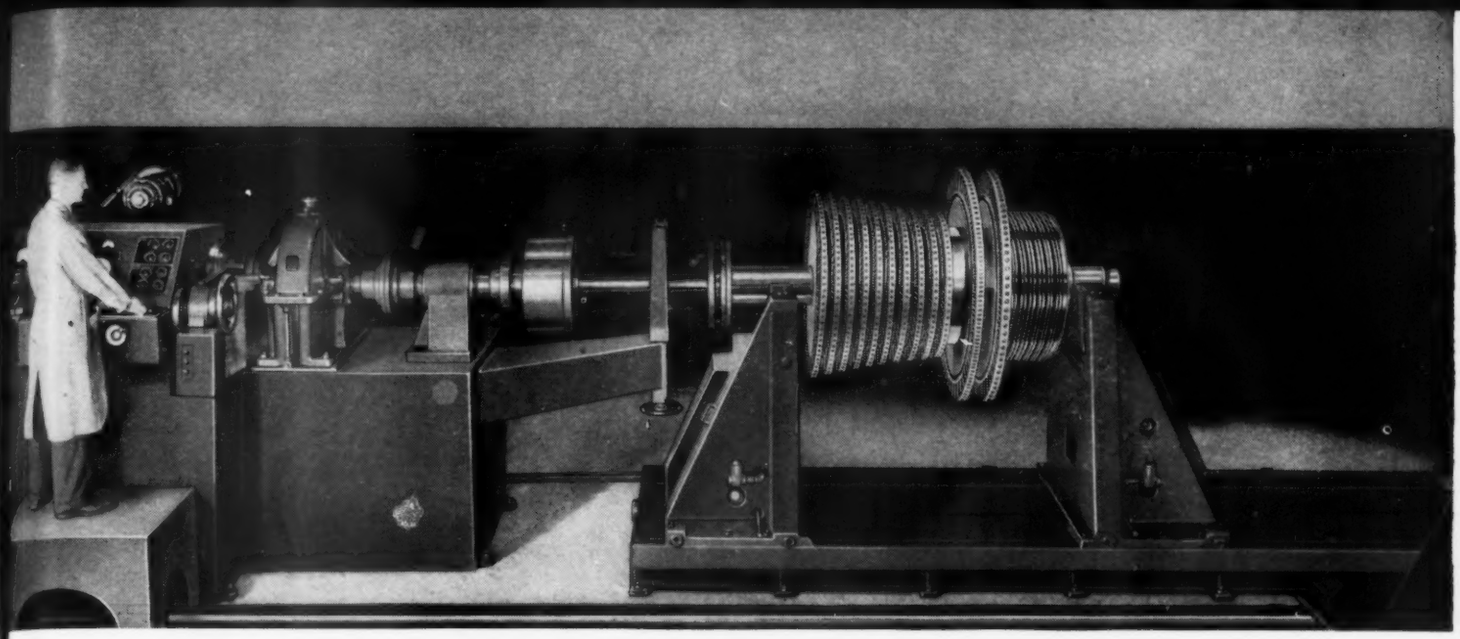


NATIONAL BROACH AND MACHINE CO.

1806 **5600 ST. JEAN** *RED RING* ○ *PRODUCTS* **DETROIT 13, MICH.**

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS



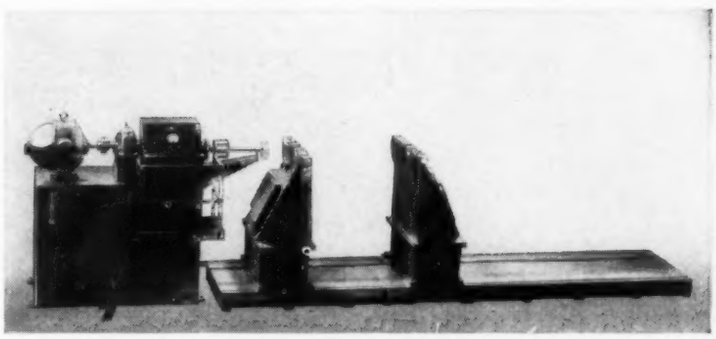
GISHOLT DYNETRICS* go to *any length* to eliminate vibration!

That's no mere figure of speech. It's literally true! For the basic principle of *Gisholt Dynetric Balancing Machines* is so flexible that it can be used to locate and measure unbalance in any rotating part, without regard for weight, size, or length of the piece.

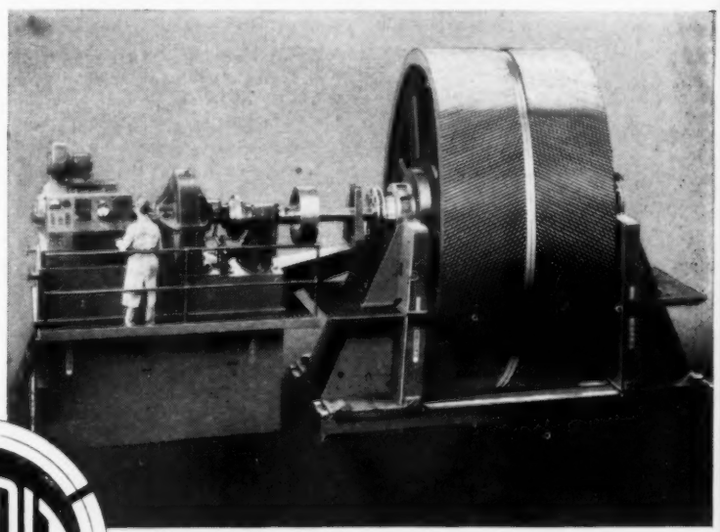
In the photo above, a Gisholt Floor Type Dynetric Balancing Machine is seen balancing a turbine spindle similar to those used for driving propellers of merchant ships and warships. This machine is capable of balancing parts with an outside diameter of 100″ and weighing up to 12½ tons. Its use eliminates destructive vibration and assures trouble-free operation over extremely long periods.

Wherever precise balance can improve the performance of your product, whether the part weighs a fraction of an ounce or many tons, there's a Gisholt Dynetric Balancing Machine to do it more quickly, more accurately, and more economically than by any other means. Write for full information.

**A development of Westinghouse Research Laboratories.*



THIS GISHOLT FLOOR TYPE DYNETRIC BALANCING MACHINE used for balancing the spindles of steam turbines, before and after blading, is capable of balancing parts having outside diameters of 150″ and weighing up to 30 tons.



This 50-ton herringbone gear used in transmitting power to the propeller of a large battleship is balanced on another Gisholt Floor Type Dynetric.

GISHOLT MACHINE COMPANY
1201 *East Washington Avenue • Madison 3, Wis.*

Look Ahead . . . Keep Ahead . . . With Gisholt

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

HALLOWELL KEY UNBRAKO KIT

With interchangeable bits

NEW! VERSATILE! BITS TO DRIVE ANY TYPE SCREW

Something new, something different . . . designed originally to materially simplify and improve the use of the Keys for driving our "Unbrako" socket set, and cap screws. It proved so handy, efficient and convenient, that we re-designed it for all commercial use.

The "Hallowell" "Unbrako" Speed Tool Key Kit is so small, it will fit into the palm of your hand. A hollow, indestructible, black plastic handle holds an assortment of interchangeable bits that enable you to drive any type of screw. The *swivel chuck* at the end of the handle permits either the direct drive of a straight-handle screw driver, as shown, or you can snap the chuck to an angle or ell position (see small cut below), so you can drive screws that would otherwise be most difficult to reach. All bits are made of the finest alloy steel, scientifically heat treated to provide a rugged product that will give you long service.

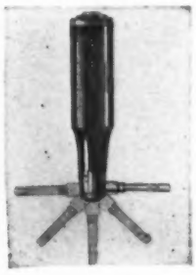


Illustration shows different positions to which swivel chuck permits bit to be swung.

Easily managed, fits comfortably in hand. Interchangeable bits are placed in hollow plastic handle.

The "Hallowell" "Unbrako" Speed Tool Key Kit is made in two sizes:

No. 25: contains seven hex, one Phillips, one slotted screw bit.

No. 50: contains six hex, two Phillips, one slotted screw bit.

If your distributor does not carry it, send his name to us, along with yours, and you will be taken care of promptly.

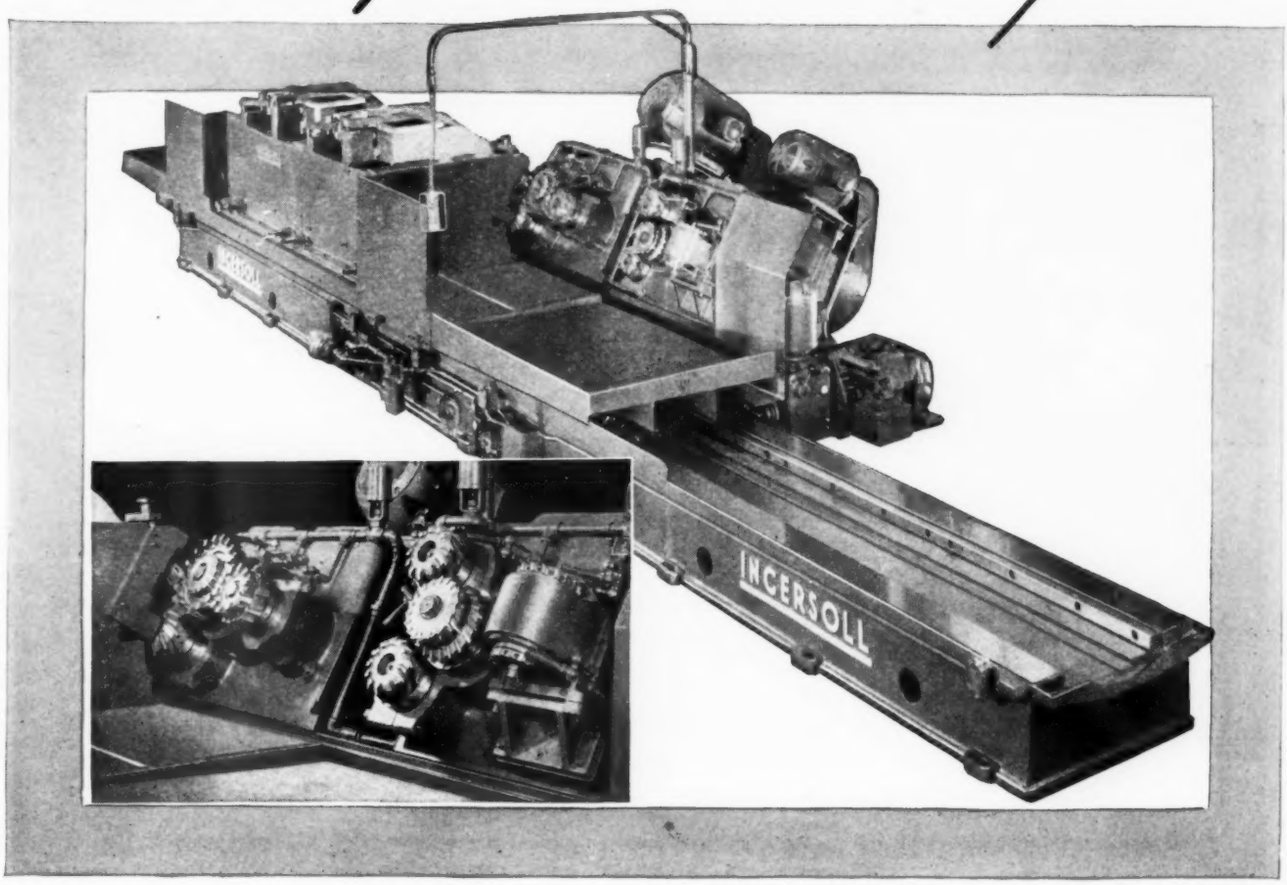
OVER 40 YEARS IN BUSINESS

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 · BRANCHES: BOSTON · CHICAGO · DETROIT · INDIANAPOLIS · ST. LOUIS · SAN FRANCISCO

INGERSOLL

Engineering . . .



designed and built this machine to mill thirteen different surfaces on diesel locomotive motor frames in one pass. It finishes two castings in one hour : : : just one-third the time expended with former standard equipment.

Ingersoll engineers . . . unhampered by convention or standardized design : : : can thoroughly analyze your individual needs from a fresh viewpoint. Whether you require a 300 ton machine or a small machine driven by a fractional horsepower motor, their experience is available to suggest machines that will profitably cut your costs. Our engineers are backed by an excellent shop well equipped to produce boring, drilling and milling machines economically . . . also milling cutters and boring bars. We will be glad to work with you on your problems.

THE INGERSOLL MILLING MACHINE CO., ROCKFORD, ILLINOIS

how to braze 18 pieces into 6 units

in 7 Seconds

Cutting costs by reducing assembly time is a neat trick . . . and here's how you can do it with induction heating.

The normal method of flame brazing this three-piece, steel tube assembly did as well as any other technique then available. But production was pitifully slow. It took minutes to complete one entire unit.

By designing a jig like the one shown above, a simplified, efficient system was found to do the job. The fixture held 6 complete units (18 separate pieces) in place firmly while a standard Westinghouse 20-kw generator brazed all six uniformly in 7 seconds! Final operation was so simple a girl could easily handle the assembly and brazing.

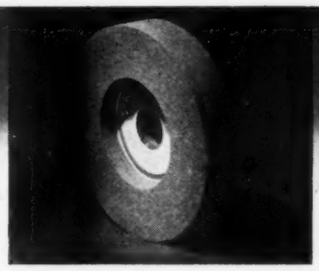
The beauty of electronic heating is its unmatched ability to do all types of heat-treating jobs quickly . . . annealing, hardening, sintering, soldering, curing, bonding and molding. Ask your Westinghouse office today for all the facts on induction heating and where it fits your operations. Or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Penna. J-08143

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronics at Work

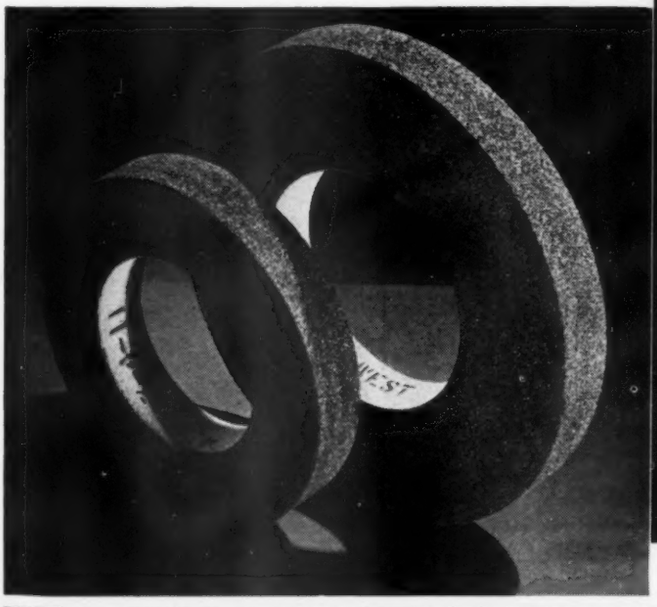
Proven QUALITY



Proven quality and dependability of performance are hallmarks of the products of the Mid-West Abrasive Company.

Mid-West's outstanding successful tool room grinding wheel, and every other product of the broad Mid-West line—honing stones, sharpening stones, coated abrasives, disks and wheel dressers—all must bear these two hallmarks.

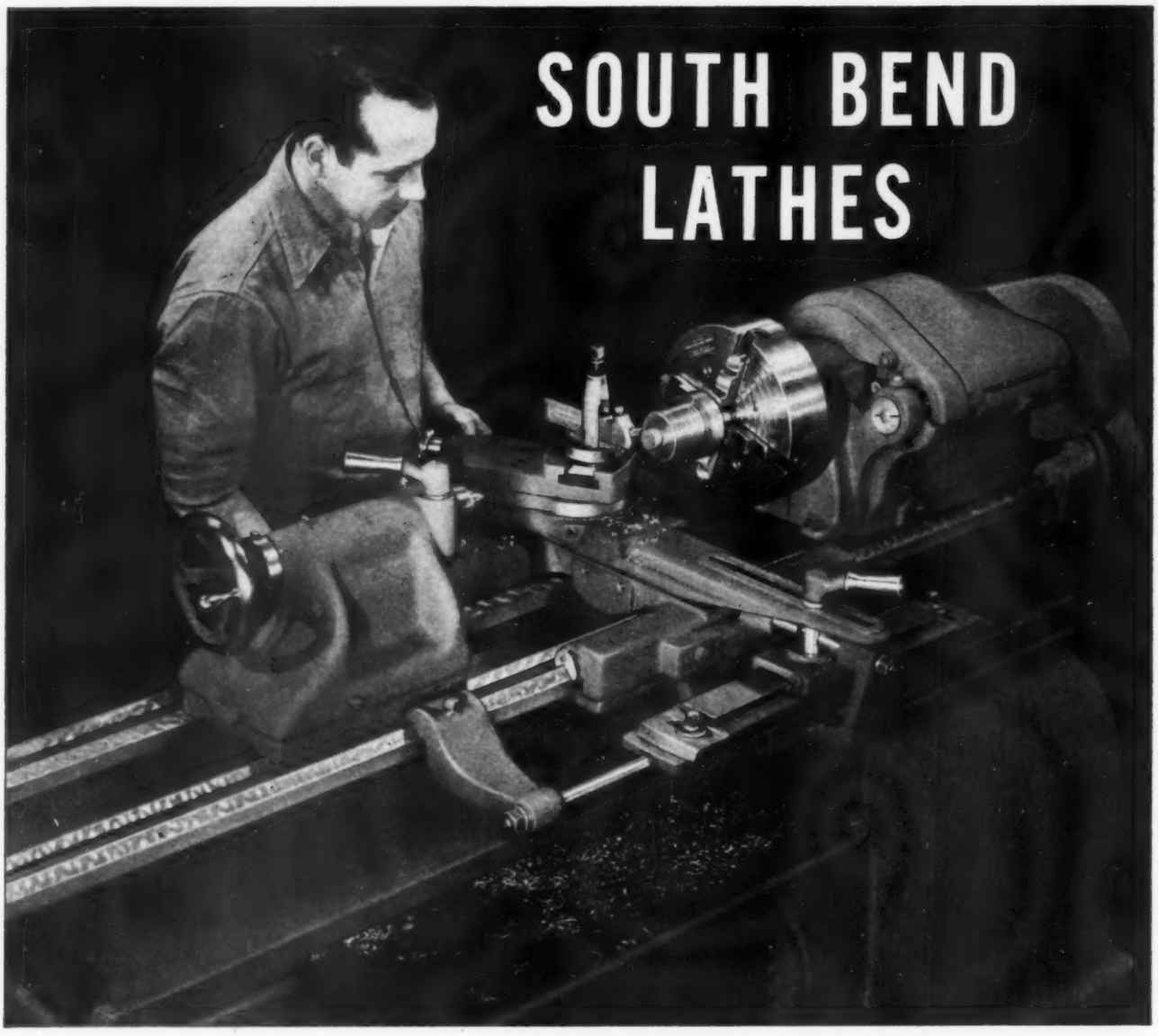
Let engineered quality and dependability guide you in your choice of abrasives, and we feel certain that choice will be Mid-West. Prompt delivery on all items.



MID-WEST ABRASIVE CO.

Manufacturers of DEPENDABLE Abrasives

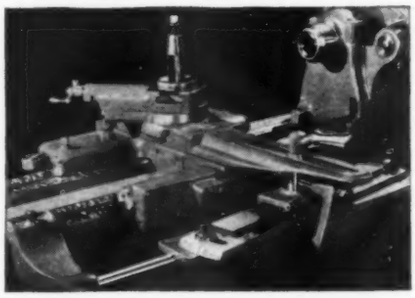
Owosso, Mich. • Detroit • Rochester, Pa.



Designed for TODAY'S Needs!

South Bend Precision Lathes are designed and built to meet the exacting needs of today's industries. Their accuracy and ability to handle a wide variety of operations raise standards of quality in the toolroom, speed tooling, keep costs to a minimum. These same features—plus speed, ease of operation, and dependability—raise quality levels in the manufacturing plant, step up the flow of production, lower costs by reducing the amount of "machine scrap," and, in some instances, by eliminating the need for one or more finishing operations.

Made with 9", 10", 13", 14½", and 16" swings, with collet capacities up to 1", and with bed lengths to 12', there is a South Bend Lathe that will meet your most exacting requirements. Prices range from $110.50 to $1673, less electrical equipment, f.o.b. factory. Write today for complete, illustrated Catalog 100-D which contains detailed specifications.



TELESCOPIC TAPER ATTACHMENT

For 10", 13", 14-1/2", and 16" South Bend Lathes

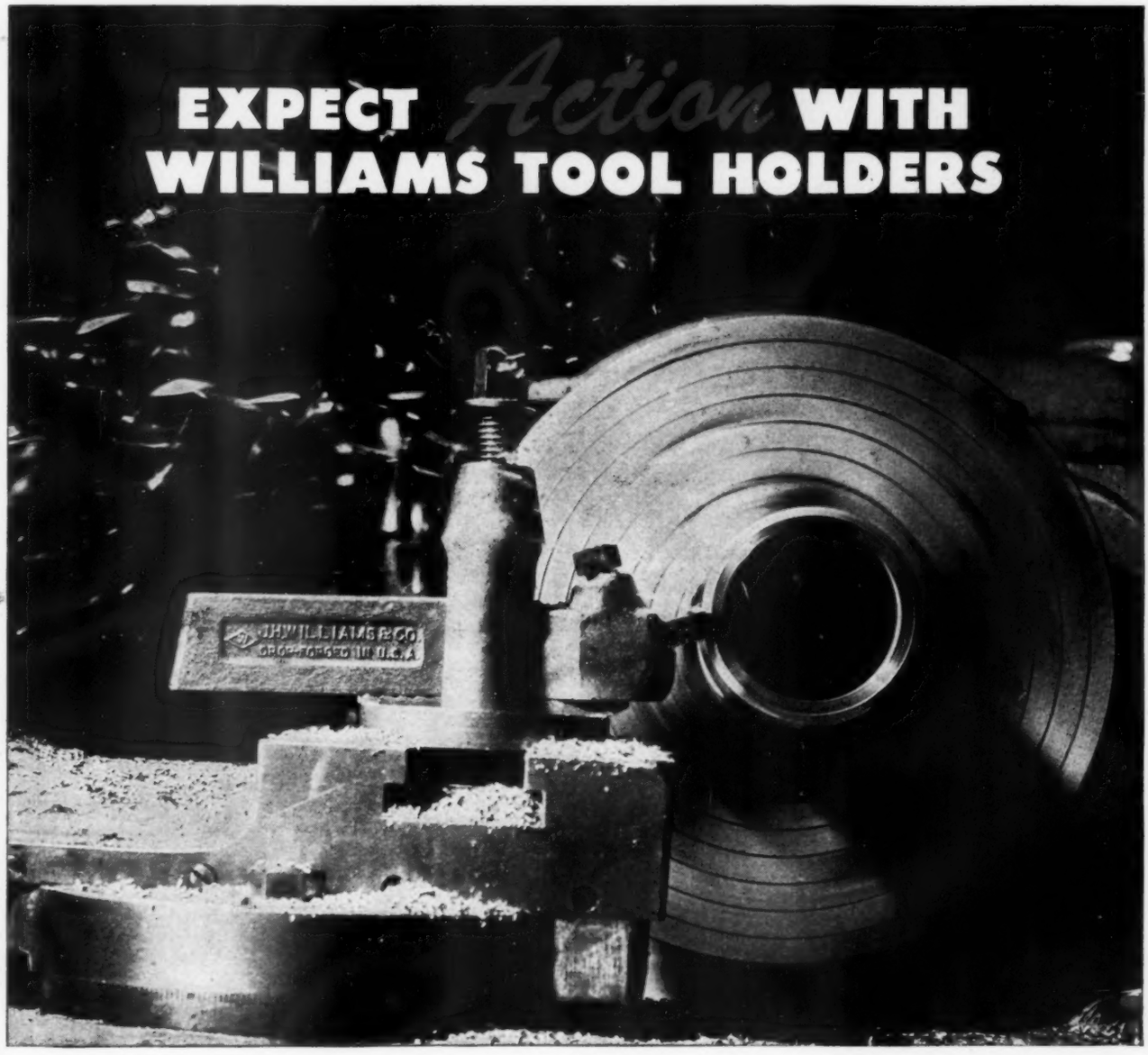
Write for Catalog 77 which illustrates and describes the complete line of South Bend Lathe attachments and accessories. Mailed without obligation.

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • SOUTH BEND 22, INDIANA

LATHE BUILDERS SINCE 1906

EXPECT *Action* WITH WILLIAMS TOOL HOLDERS

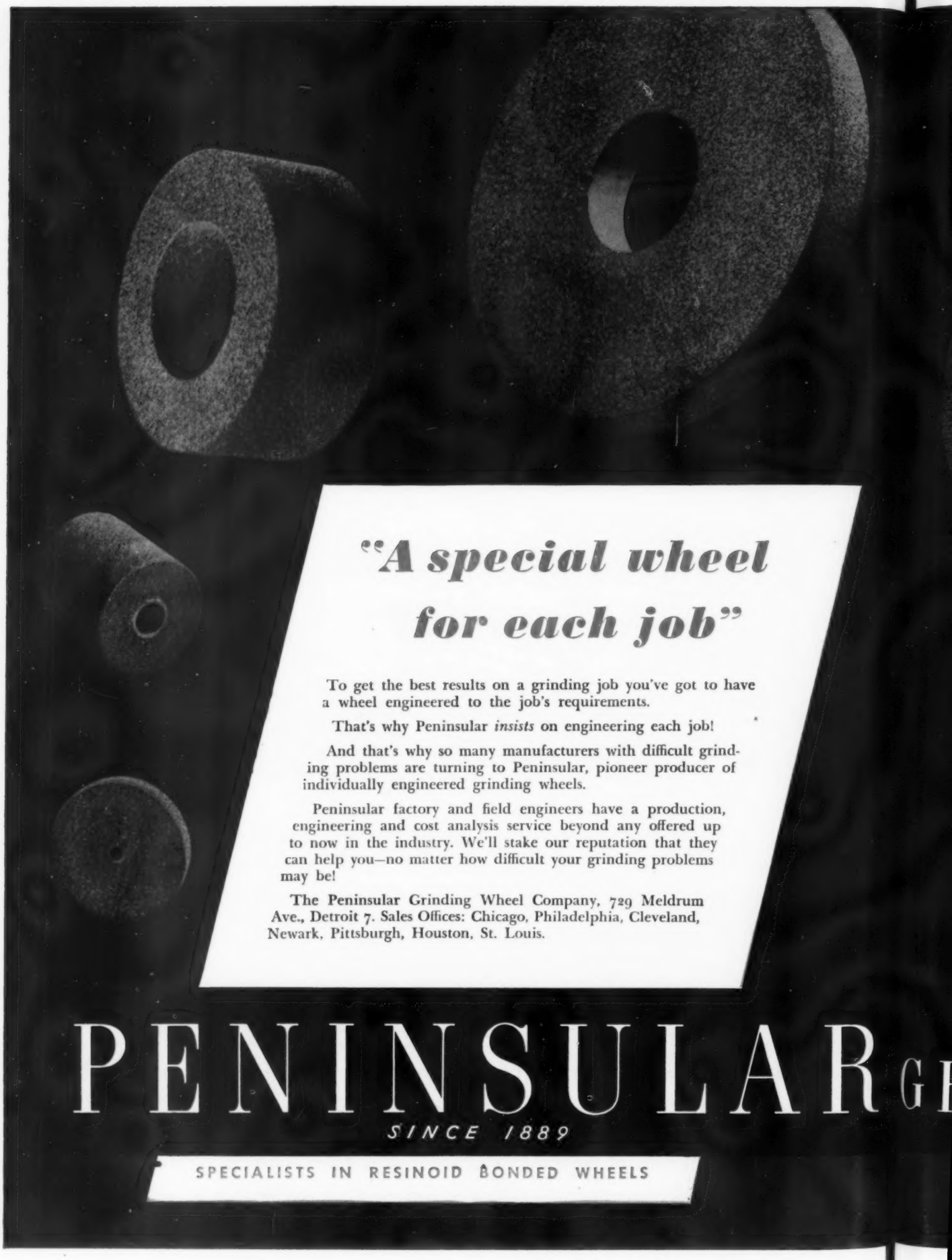


YOU'LL FIND A WILLIAMS HOLDER for every regular operation on lathe, planer and shaper . . . each functionally designed for super performance . . . all built to withstand the rigors of continuous high production.

For fast, chatter-proof, clean-cutting service, be sure to specify Williams Regular or Carbide Cutter-Bit Holders. Sold by Industrial Distributors everywhere.

J. H. WILLIAMS & CO., BUFFALO 7, N. Y.

WILLIAMS
DROP-FORGINGS AND DROP-FORGED TOOLS



"A special wheel for each job"

To get the best results on a grinding job you've got to have a wheel engineered to the job's requirements.

That's why Peninsular *insists* on engineering each job!

And that's why so many manufacturers with difficult grinding problems are turning to Peninsular, pioneer producer of individually engineered grinding wheels.

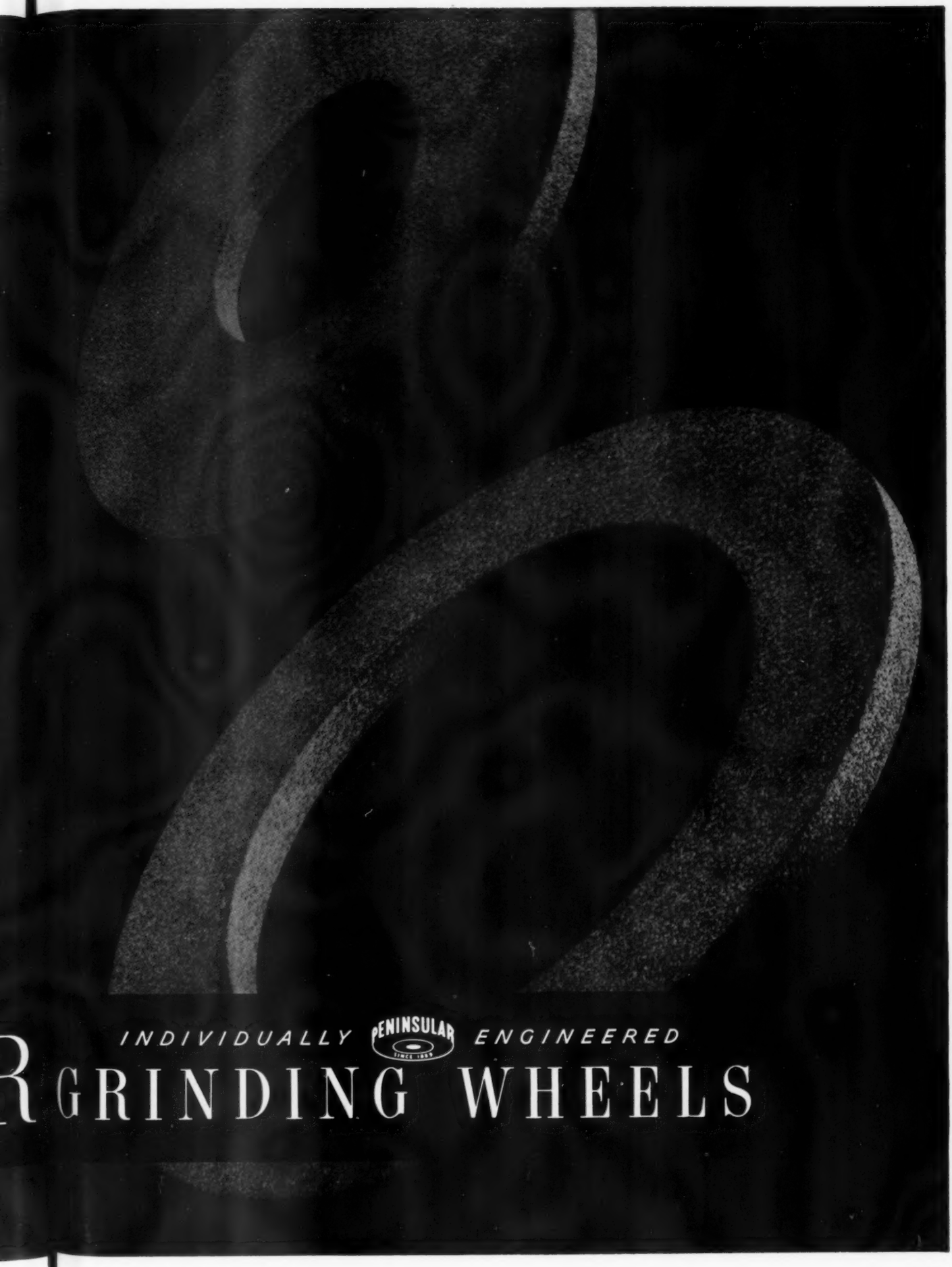
Peninsular factory and field engineers have a production, engineering and cost analysis service beyond any offered up to now in the industry. We'll stake our reputation that they can help you—no matter how difficult your grinding problems may be!

The Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7. Sales Offices: Chicago, Philadelphia, Cleveland, Newark, Pittsburgh, Houston, St. Louis.

PENINSULAR GR

SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS


INDIVIDUALLY PENINSULAR ENGINEERED
GRINDING WHEELS

HERE'S THE PRACTICAL *Solution* TO DIFFICULT TURNING OPERATIONS...

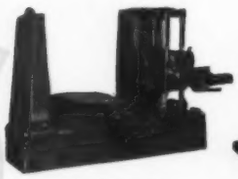
G.&L. Horizontal Boring Machines Equipped with Standard Attachments Offer the Simplest Overall Means of Machining Unwieldy Work

Hard-to-approach jobs such as these stub trunnion turning operations show how one class of difficult work is handled more easily and faster on Giddings & Lewis Horizontal Boring Machines. This is but a single example of the many practical machining possibilities open to the user of G. & L. equipment.

Continuous Feed Facing Heads accurately turn the trunnions on both the 33" diameter suction elbow and on the welded slide mechanism. *Dimensional tolerances and alignments are held to required specifications.* On no other type of equipment can such unwieldy, awkward pieces be machined with equal speed and facility.

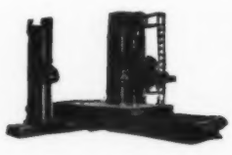
Additional Machine Functions With or Without Standard Attachments

Extensive general-purpose milling, drilling, boring, threading, tapping and similar operations are easily performed on the standard G. & L. machine. Or, if the machine is equipped with suitable standard attachments or accessories, its work handling capacity may be increased. Inquire now of experienced Giddings & Lewis engineers how to use versatile and flexible G. & L. horizontal boring machines to your advantage. These men will be glad to offer practical and profitable suggestions for simplifying your general and specific machining problems.

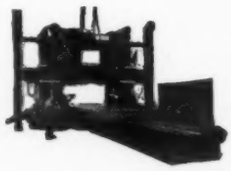


G. & L. Table Type Machine

G. & L. Floor Type Machine

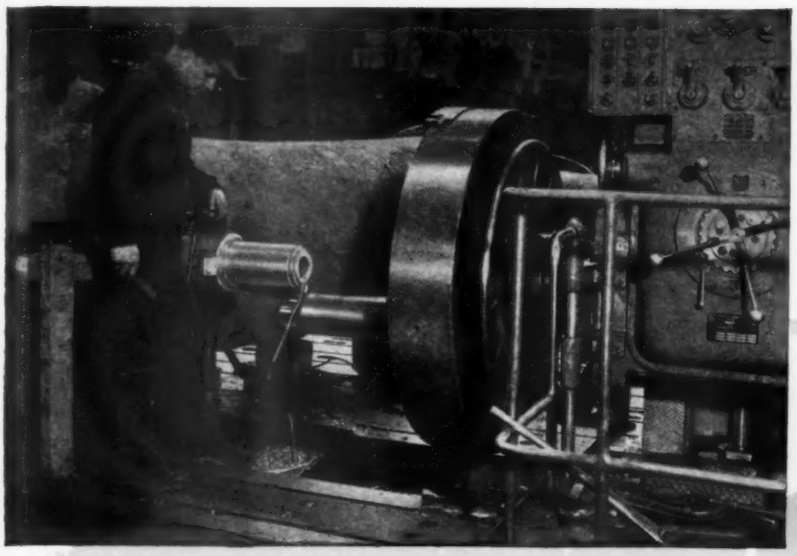


G. & L. Planer Type Machine

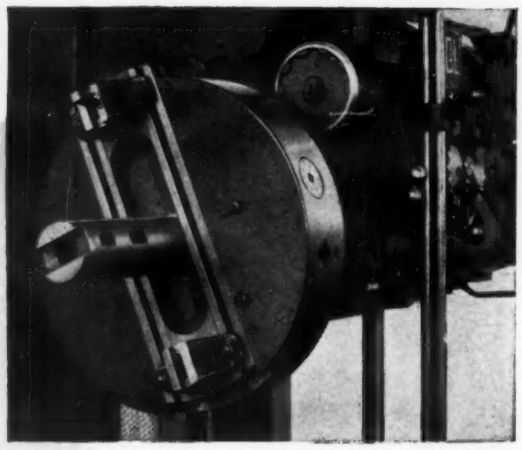


G. & L. Multiple Head Type Machine

GIDDINGS & LEWIS MACHINE TOOL CO.



Stub trunnion on a 33" diameter suction elbow being turned on a G. & L. floor type machine. Note the simple method of mounting the odd shaped workpiece and the use of the Continuous Feed Facing Head Attachment.

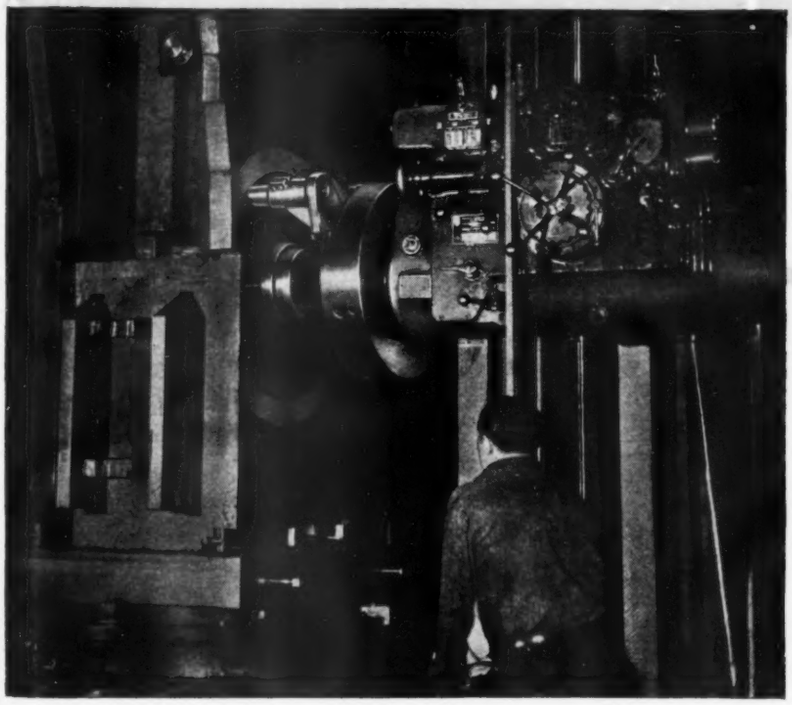


Standard Continuous Feed Facing Head Attachment for use on table, floor or planer type machines.

CONTINUOUS FEED FACING HEAD

This attachment is designed to simplify and speed the production of numerous difficult machining jobs. It is used for internal and external turning operations, for internal boring, grooving, recessing and threading. It is also used to perform a variety of rough and finish facing operations, and back facing operations when telescopic tools are employed. With this highly flexible attachment it is possible and practical to combine machining cuts, thus lowering production time. The working range of your Giddings & Lewis Horizontal Boring Machine is materially increased through its use.

Facing and turning operations performed on a G. & L. table type machine with a Continuous Feed Facing Head. Welded slide mechanism is mounted on a rotary table to facilitate indexing.

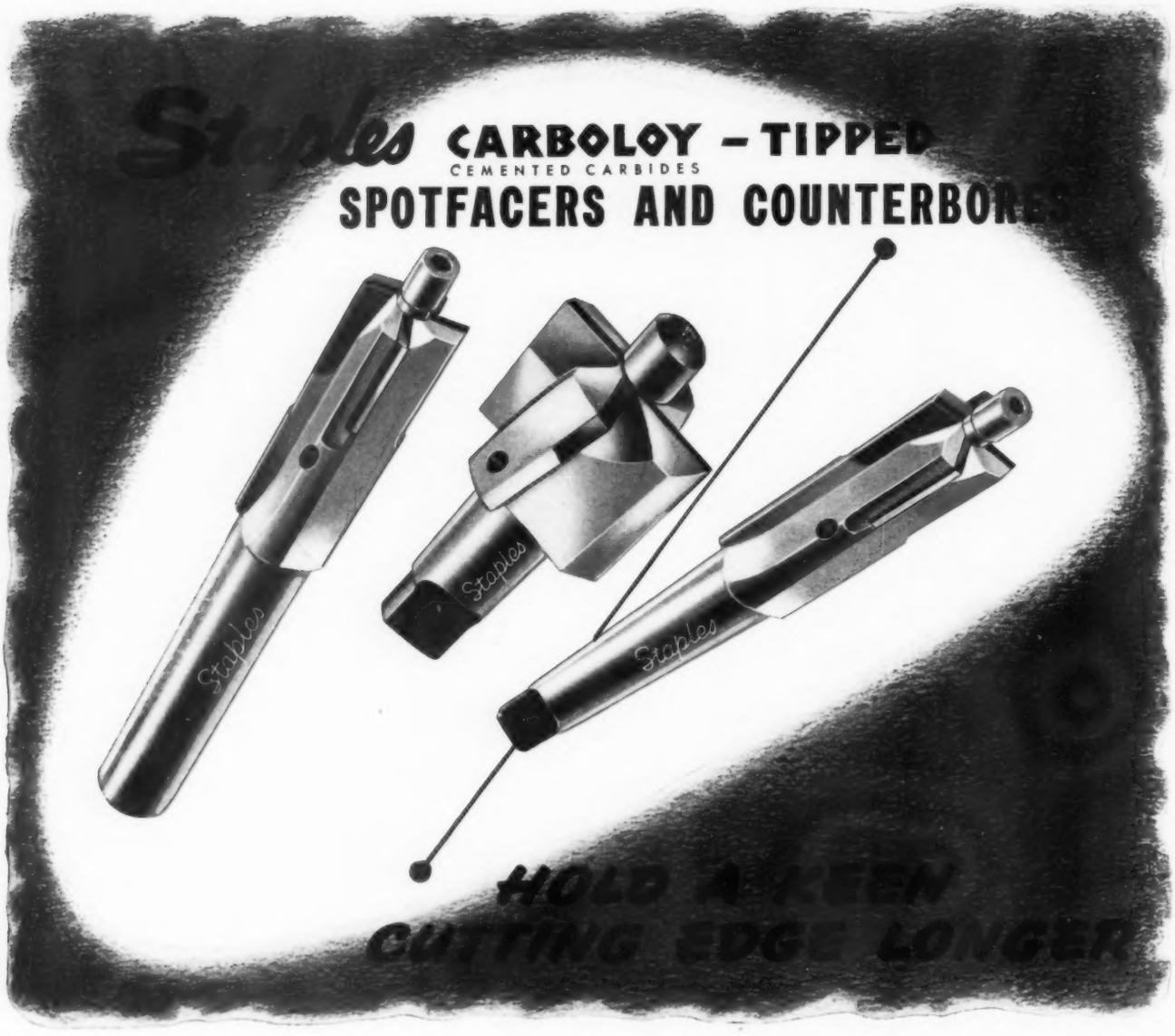


Note: Photographs through the courtesy of Danly Machine Specialties, Inc., Chicago, Illinois and Joshua Hendy Iron Works, Sunnyvale, California.

Valuable

FIELD PRODUCTION FACTS will point the way to improved machining methods. Write today for your FREE file of actual case histories as presented in G. & L. Production Data Folder AM-26.

138 Doty Street • Fond du Lac, Wis.



Your economy begins, your quality improves, the moment a Staples Carboloy-tipped Tool starts revolving in the job.

Staples Spotfacers and Counterbores, with their diamond-ground Carboloy cutting edges, make easy work of cutting through highly abrasive casting scale. While ordinary tools are breaking down and killing valuable time, Staples Spotfacers and Counterbores remain keen and eager—produce the tolerances you seek, quicker—perform over and over at the peak of efficiency.

Staples engineers build superiority into Staples Tools by devoting their exceptional skills to a single objective—the making of circular cutting tools that serve longer and better. You are invited to investigate the cost-saving advantages in the Staples line . . . which includes Reamers, solid and expansion types; End Mills; Spotfacers and Counterbores. Standard tools available from stock; special tools designed to order. Write for complete catalog. *Distributors in Principal Cities.*

THE STAPLES TOOL COMPANY

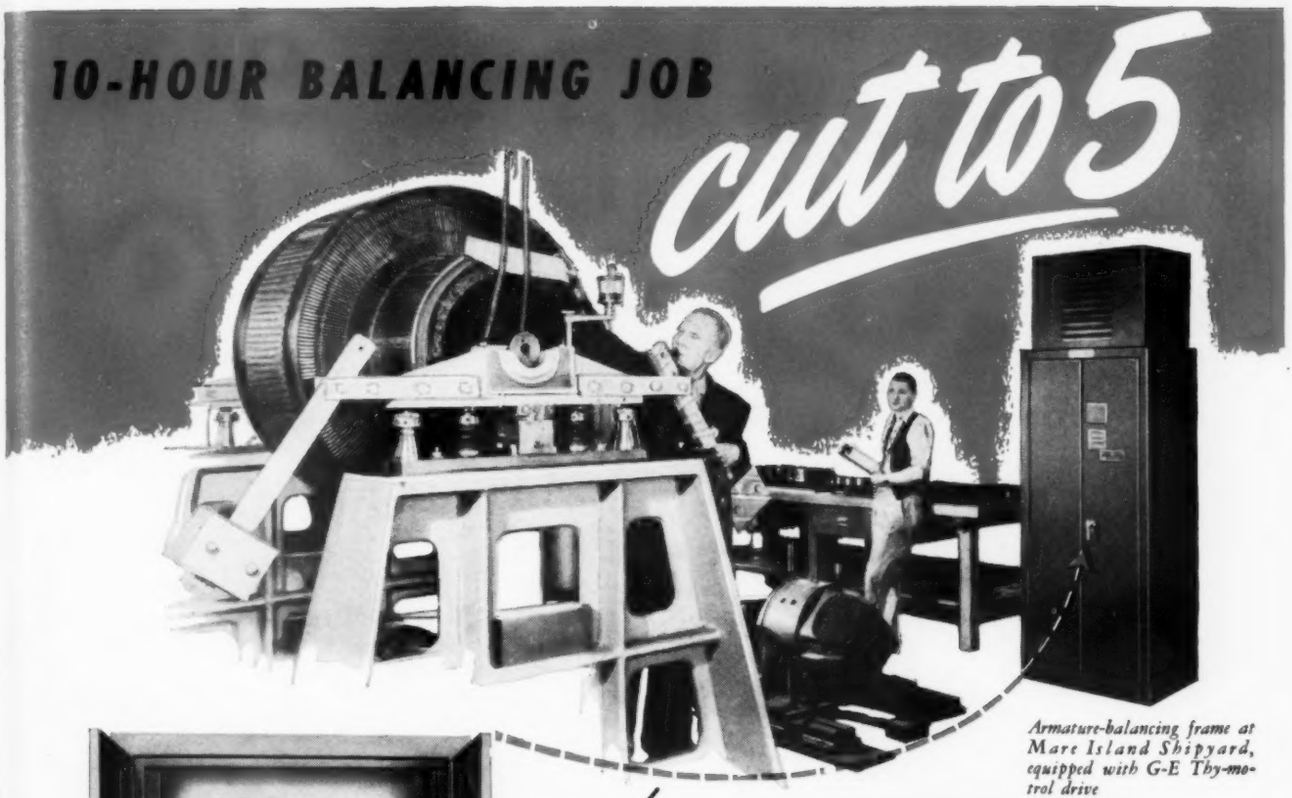
Formerly Staples Tool & Engineering Company

CINCINNATI 25 **OHIO**

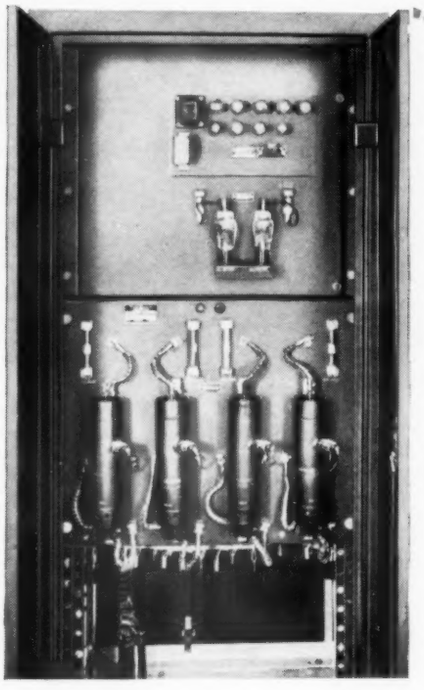
Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES • END MILLS • SHELL END MILLS • ALSO A COMPLETE LINE OF CIRCULAR SPECIAL TOOLS

10-HOUR BALANCING JOB *cut to 5*



Armature-balancing frame at Mare Island Shipyard, equipped with G-E Thy-mo-trol drive



Interior of Thy-mo-trol control panel. Rectifier tubes convert a-c to controlled d-c.

...by ELECTRONIC *Speed Control*

To balance the heavy armatures of the motors that power Navy submarines, test runs must be made over a wide range of speeds, with frequent stops and starts as weights are readjusted. Always a precision job at the Mare Island Navy Yard, armature balancing is now a *fast* precision job, thanks to a G-E Thy-mo-trol drive on the balancing machine.

The speed for any run is just preset on a dial, and the drive automatically and smoothly accelerates the armature up to this speed. Manual adjustments which were formerly a two-man operation are no longer necessary.

Again, when the stop button is pressed, the drive performs an electric braking function, bringing the armature on test to a stop in a matter of seconds, as compared with two to four minutes required previously. This permits an entire testing cycle to be completed in 37 seconds!

OPERATES FROM A-C POWER

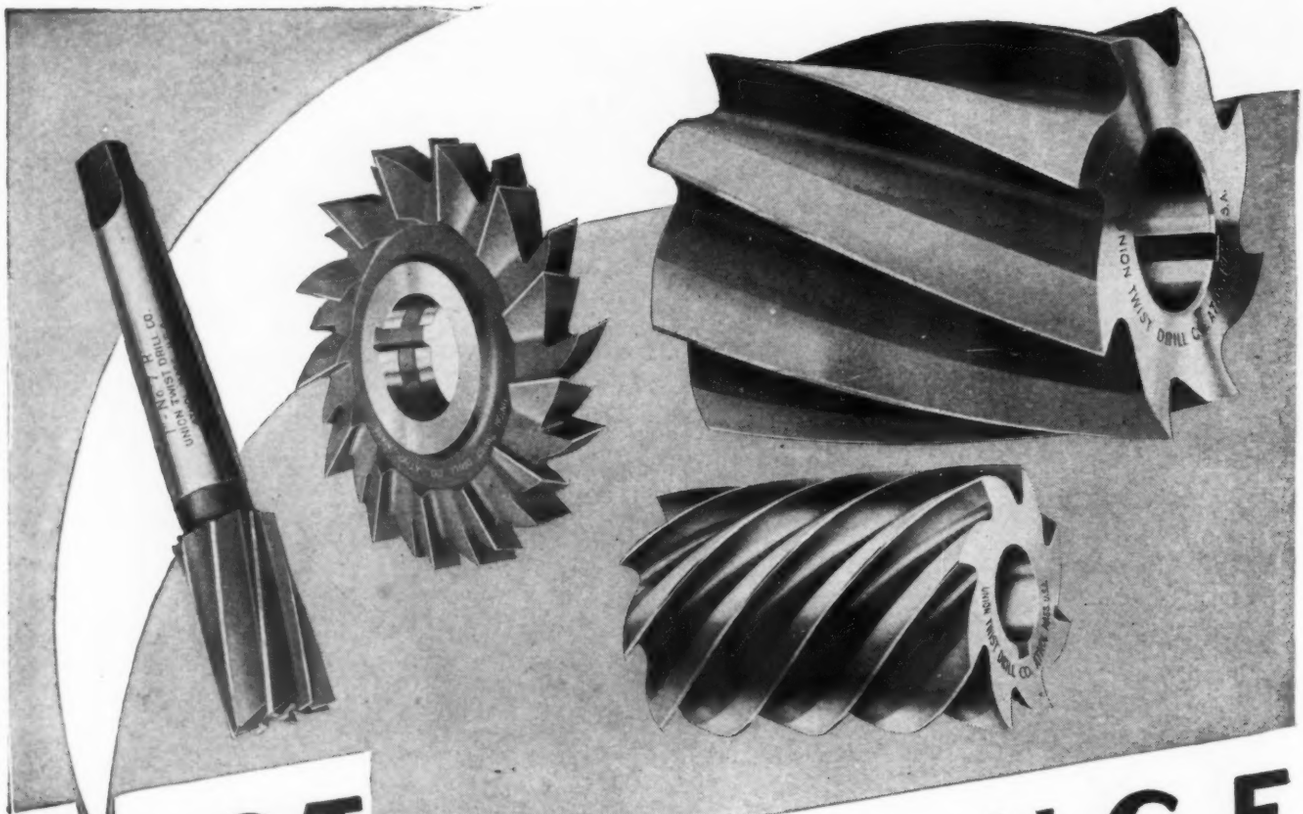
Saving time on testing machines is only one of hundreds of jobs now being found for Thy-mo-trol drives—on machine tools, processing equipment, and wherever stepless control of speed is an advantage. Standard Thy-mo-trol drives are available from 1/8 to 25 hp, and larger sizes can be furnished. All are operated directly from an a-c power supply.

Each Thy-mo-trol drive is a completely co-ordinated equipment, including d-c motor, electronic panel, transformer, and control station. G-E engineers will help you select and apply Thy-mo-trol drives to your machines, or explore their suitability for new functions. Ask for Bulletin GEA-4025. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

THY-MO-TROL *Drive*

GENERAL ELECTRIC

676-192-8930



PAST PERFORMANCE

...a safe guide for "The Tools You Buy Again"

Actual results—in terms of better, faster, more economical work—make standardization on UNION TOOLS a logical procedure and a sound policy. Years of specialization in development and manufacture has enabled UNION to produce long-lived, dependable small tools—tools that help keep production moving at maximum speed and accuracy at a minimum of expense.

Once you've put UNION tools to work, they'll be the "Tools You Buy Again." Performance will have been the basis for your choice.

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Athol, Mass.

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S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

THE UNION LINE

Twist Drills—Milling Cutters—Reamers—Hobs—Slitting Saws—End Mills—Taps—Dies—Screw Plates—Profile Cutters.

UNION

Try the New FLEXARC SW-2 ELECTRODE — on the House!

(A KING-SIZE SW)

It's the "operator's own electrode"—the new Flexarc SW-2—developed by Westinghouse in diameters from $\frac{3}{16}$" to $\frac{5}{16}$" because of the widespread demand for the smaller diameter SW electrodes.

This new cost-cutting electrode gives extra footage of weld because of its flat fillet contours. The SW-2 has smooth uniform metal transfer with full side wall wash up. It gives equally good results—with a-c or d-c in all positions—on wrought iron, low or medium carbon steel, low-alloy, high strength steel, copper bearing steel and on low and medium carbon cast steel.

Both operators and supervisors are invited to check these facts on their own production—using the free samples which will be sent on request.

J-21368

Westinghouse
PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

FLEXARC ELECTRODES

GET FREE SAMPLES OF SW-2 ELECTRODES

Try these new electrodes on your own jobs. They're unexcelled for—

All-position welding—single or multiple-pass fillets and butts, with a-c or d-c—

Flat contours without undercut, yield more weld footage per pound of electrode—

Self-freeing slag characteristics—cuts cleaning time with a resultant saving—

Easy manipulation and striking characteristics in open or close welding spaces—makes the operator's job easier—

Excellent root penetration with unusually good x-ray welds.

Ask for your *Free Samples* . . . specifying diameter used . . . on your company letterhead . . . to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

Send for this new booklet. Gives complete details of SW-2 performance, time and cost reduction. Ask for B-3710.

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Carbide

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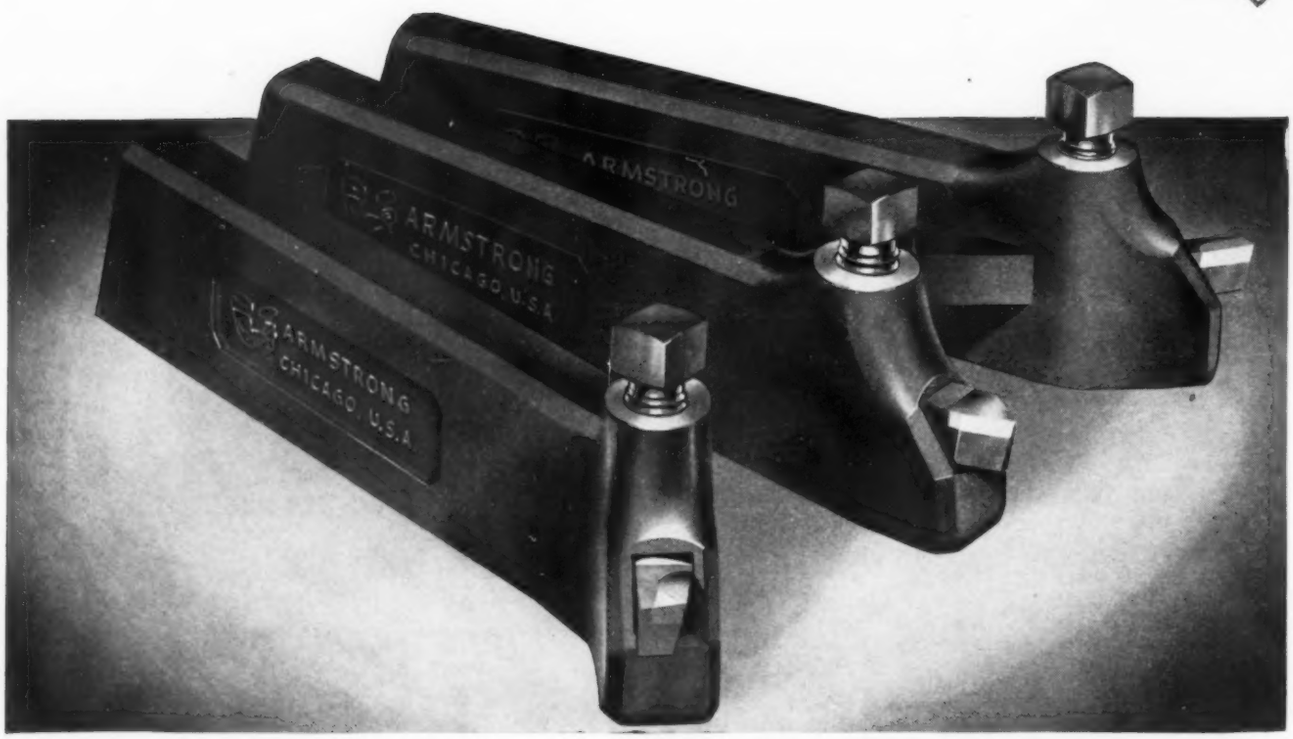
ARMSTRONG Carbide TOOL HOLDERS have been specially designed and engineered for use with Carbide-tipped tool bits, and embody the special characteristics essential for the efficient use of carbide-tipped cutters, namely; great strength, extreme rigidity and close-up support for the cutting edge. The ARMSTRONG Carbide TOOL HOLDERS System makes the use of carbide tools practical for everyday operations in tool rooms, maintenance departments and machine shops. Each takes interchangeable carbide-tipped tool bits ground to different cutter shapes . . . each tipped cutter can be used in a "Straight Right Hand Off-Set" or "Left Hand Off-Set Tool Holders." Hence a small investment in ARMSTRONG Carbide TOOL HOLDERS and carbide-tipped cutter bits can turn those hard-to-do machining operations into "just another routine job," changing losses into profits.

ARMSTRONG Carbide TOOL HOLDERS and Armide or other Carbide-tipped cutter-bits are now available at leading industrial supply houses.

Buy ARMSTRONG Tools from your Supply House



ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* **315 N. Francisco Ave., Chicago 12, U. S. A.**

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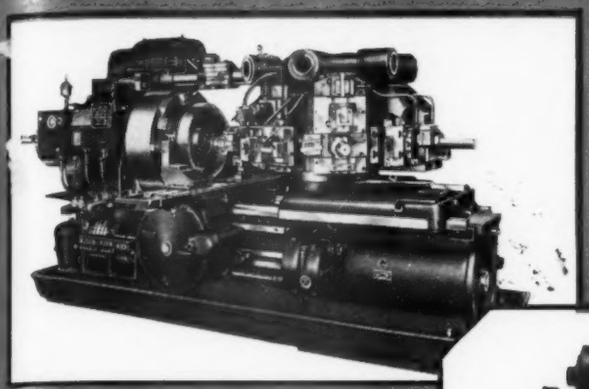
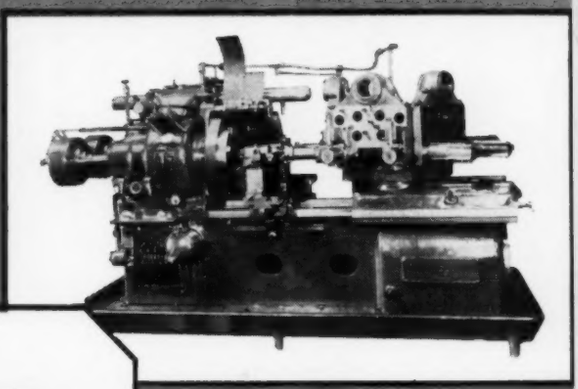
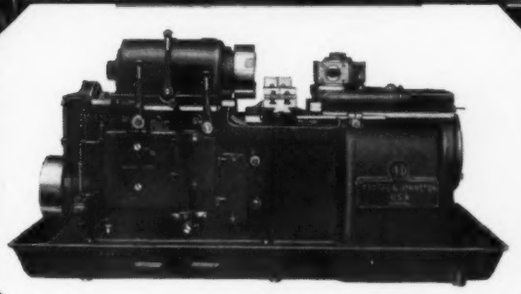
P&J



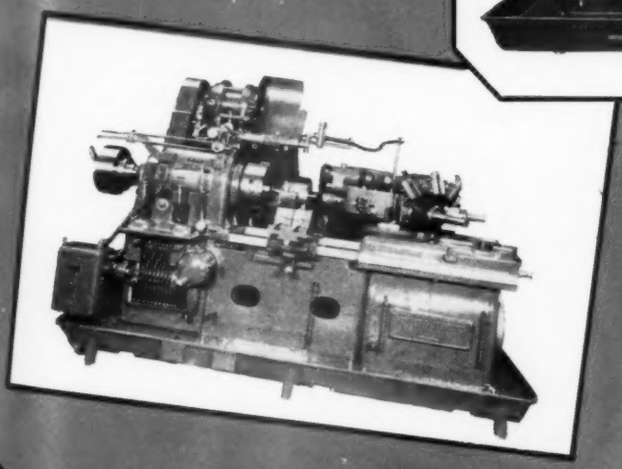
P&J 8DT and 8DXT Automatics
Bulletin 112



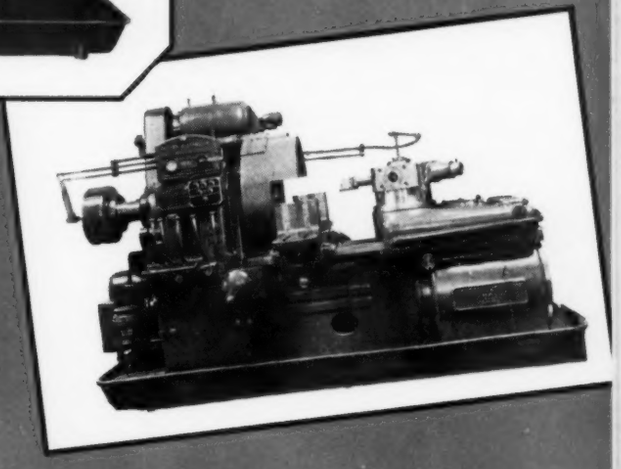
P&J 5D Two Spindle Power-Flex
Automatic. Bulletin 120



P&J 4D Automatic
Bulletin 112



P&J 5D Power-Flex Automatic
Bulletin on request



P&J 6DREL and 6DRELX
Automatics. Bulletin 118

AUTOMATIC CHUCKING *and* TURNING MACHINES

There are no practical limits to the variety of work these machines will handle

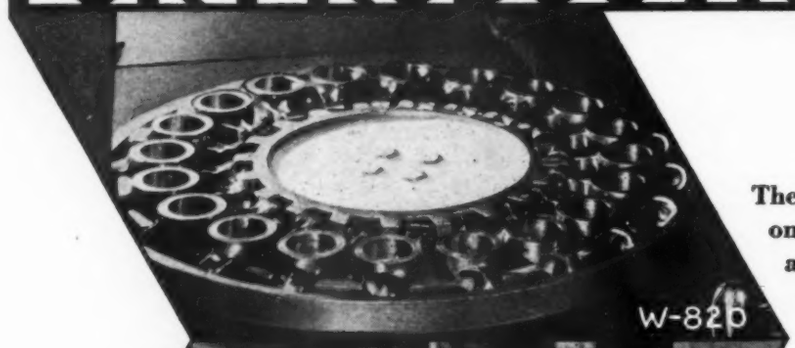
These five models in the P&J line are designed to meet all needs of metal working shops for high production of duplicate parts at low cost for power, labor and maintenance. The capacity range covered by these machines is inclusive, parts small or large being handled with equal facility and at closely and easily held tolerances. Tooling to meet specific requirements is an inherent, advantageous feature of every machine in the P&J line.

Send for illustrated, descriptive literature

BUY VICTORY BONDS TODAY FOR SECURITY TOMORROW

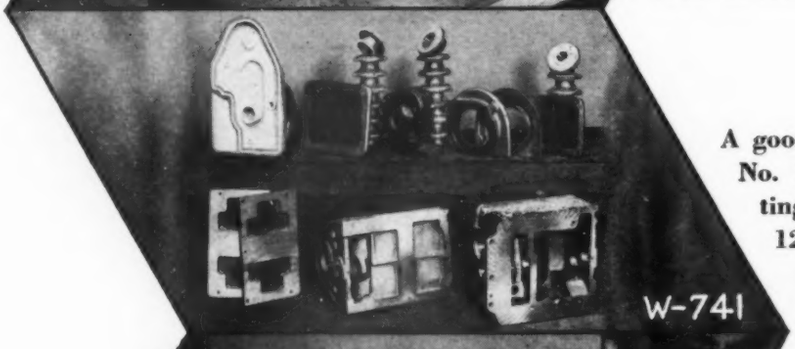
POTTER & JOHNSTON MACHINE CO.
Pawtucket, R. I.

FOR PRODUCTION PUT IT ON THE BLANCHARD

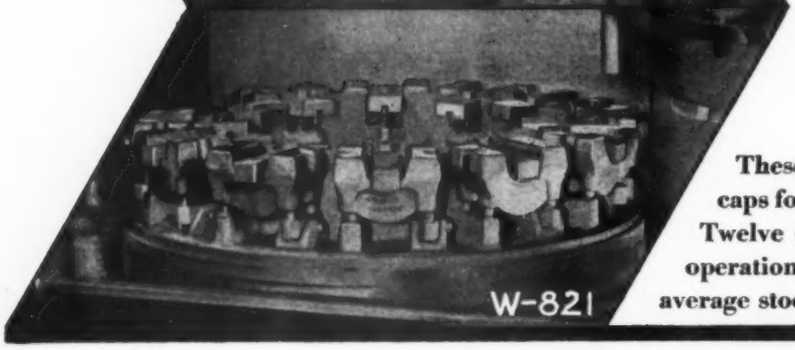


These steel forged rocker arms are ground on a No. 11 Blanchard Surface Grinder and 1800-2000 pieces are produced per eight hour shift, stock removal .005" to commercial limits.

One of many airplane engine parts ground on the No. 18 Blanchard Surface Grinder. 109 of these nickel steel cams are produced per hour, stock removal .040" to .060", to ± .001".



A good example of the way Blanchard No. 18 Surface Grinders are eliminating hand scraping. Fifteen Gear boxes 12" x 12" x 3" or 30 surfaces are ground per hour, removing .070" each side for oil-tight joints.



These nickel steel forgings are bearing caps for the master rods of radial engines. Twelve of these caps are ground in one operation requiring only 27 minutes, average stock removal .075".

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.

TO CROSS THE LAND · · · TO PIERCE THE SKY

1928 "Bell-hole" welding of pipe lines, where downhand position welds were not feasible, led to development by A. O. Smith in 1928 of the all-position electrode . . . a great stride forward in the art of welding.

1946 Everywhere vertical and overhead welding is necessary today—in erecting skyscrapers, fabricating bridges, building subways and ships—the SMITHway all-position electrode makes welding the builder's most modern production tool.

MILLIONS of SMITHway Certified Welding Electrodes are used by builders and manufacturers everywhere. More than 320,000 have been used daily in A. O. Smith plants alone . . . in the fabrication of steel products that range from the smallest and simplest to the largest and most complex.

For the proof of SMITHway Electrodes is in actual production—day-to-day plant and field operations, backed by the A.O. Smith program of welding research that never ends.

Write for the SMITHway Welding Catalog for detailed specifications of SMITHway Certified Electrodes and their application to specific welding jobs.

Mild Steel . . . High Tensile . . . Stainless Steel
WELDING ELECTRODES
made by welders . . . for welders

SMITHway
A. C. WELDERS

Reduce Spatter . . . Eliminate Arc Blow. The expanded line of SMITHway A. C. Welders now includes six models—150-, 200-, 250-ampere capacity; and for heavy duty, 300-, 400-, and 500-ampere capacity. Write for prices and specifications.

SMITHway Certified WELDING ELECTRODES

A. O. SMITH Corporation

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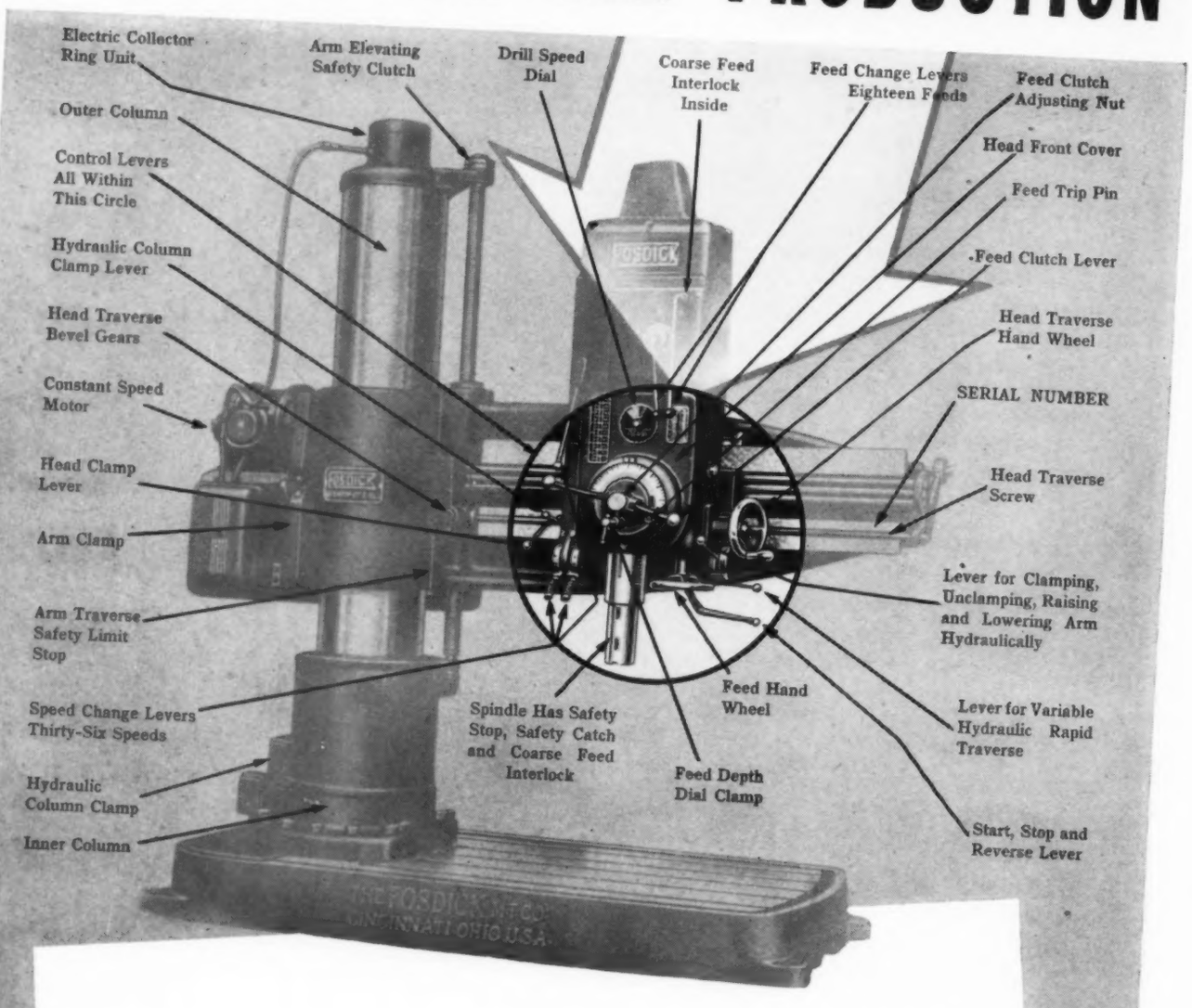
INTERNATIONAL DIVISION: MILWAUKEE 1 • In Canada: JOHN INGLIS CO., LIMITED

Within this circle is the answer to FOSDICK *Low Cost* PRODUCTION


Electric Collector Ring Unit
Arm Elevating Safety Clutch
Drill Speed Dial
Coarse Feed Interlock Inside
Feed Change Levers Eighteen Feeds
Feed Clutch Adjusting Nut
Outer Column
Head Front Cover
Control Levers All Within This Circle
Feed Trip Pin
Hydraulic Column Clamp Lever
Feed Clutch Lever
Head Traverse Bevel Gears
Head Traverse Hand Wheel
Constant Speed Motor
SERIAL NUMBER
Head Clamp Lever
Head Traverse Screw
Arm Clamp
Lever for Clamping, Unclamping, Raising and Lowering Arm Hydraulically
Arm Traverse Safety Limit Stop
Feed Hand Wheel
Speed Change Levers Thirty-Six Speeds
Spindle Has Safety Stop, Safety Catch and Coarse Feed Interlock
Lever for Variable Hydraulic Rapid Traverse
Hydraulic Column Clamp
Feed Depth Dial Clamp
Inner Column
Start, Stop and Reverse Lever
THE FOSDICK M'F'G CO.
CINCINNATI OHIO U.S.A.

• Saving steps—reducing operator fatigue—providing ease of operation—all are points included in Fosdick Radial Drill design and construction. They are points that make production easier—faster—and lower in cost.

The centralization of controls—the hydraulic operation of arm and head traverse and column clamping make for quick, effortless control of important machine functions and place within instant reach 36 spindle speeds—18 feeds and three tap leads. The operator has full control of machine from normal working position.

The rigid base construction—sturdy column design and massive well balanced arm assure the utmost in maintaining desired tolerances.

Put your Radial Drill work on a Fosdick for greater production—continued accuracy and low costs. Fosdick Radial Drill Bulletin RA available.

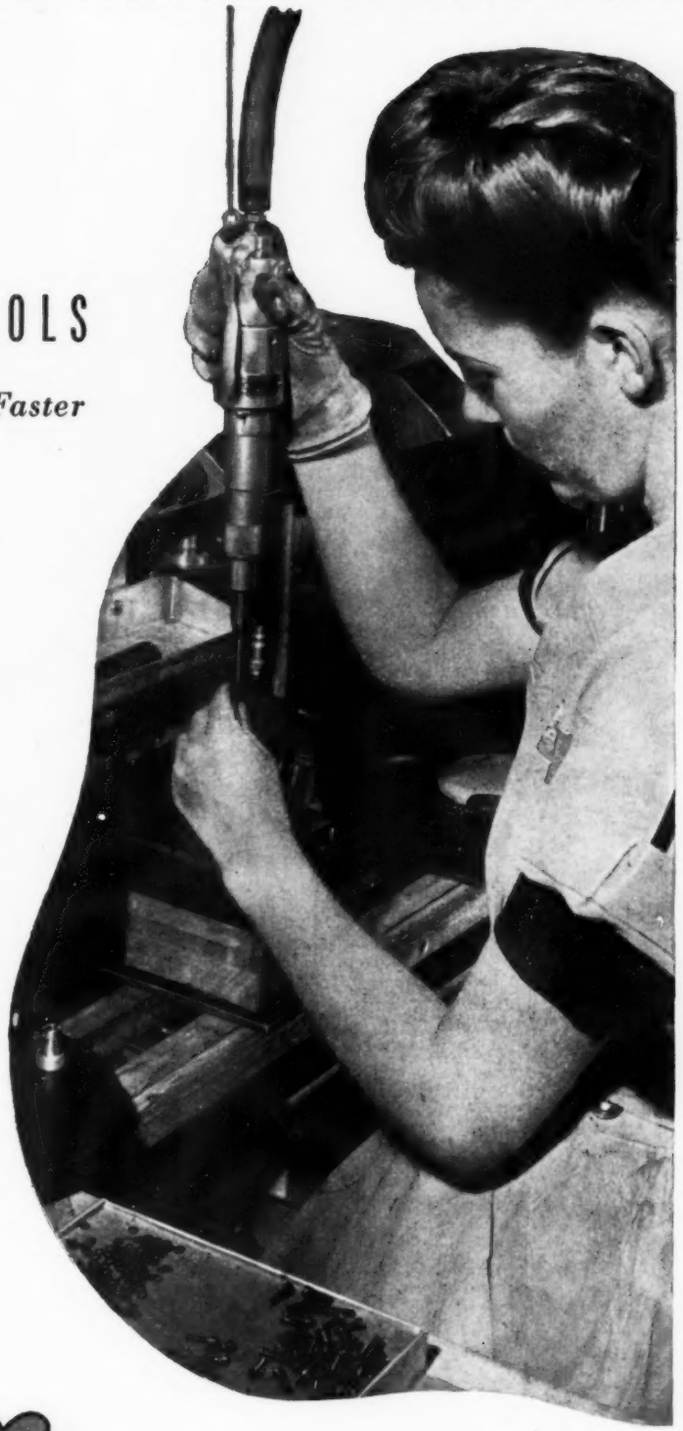
FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

There are Six HIDDEN HANDS *in this Picture*

Thor

PNEUMATIC
ASSEMBLY TOOLS

Drive Screws, Set Nuts, Three Times Faster Than Hand Tools



The *picture* shows this girl's two hands operating a Thor 217 Pneumatic Screwdriver.

But, if you could *watch the job* you would see in the speed with which this girl completes assemblies a ratio of "six hidden hands" inside that Thor tool which help her assemble *faster . . . surer* than any three operators using hand tools.

NO HUMAN HAND can approach the unfailing accuracy, precision and speed with which Thor pneumatic assembly tools drive screws and nuts. On most models, an *adjustable* clutch, invented and perfected by Thor, controls precisely the tightening of the fastener to the exact tension required. No guesswork, no "feeling your way"—each screw or nut is *right* every time.

And you get *safe speed*—for, while Thor screw and nut drivers are amazingly fast and powerful, automatic governors and precision gears adapt torque and speed to the tool application at hand.

If you have assemblies you want to speed up with Thor's "six hidden hands" don't hesitate—write or call your nearest Thor branch today.

INDEPENDENT PNEUMATIC TOOL COMPANY
600 W. Jackson Boulevard, Chicago 6, Illinois

BIRMINGHAM · BOSTON · BUFFALO · CLEVELAND · DETROIT · LOS ANGELES
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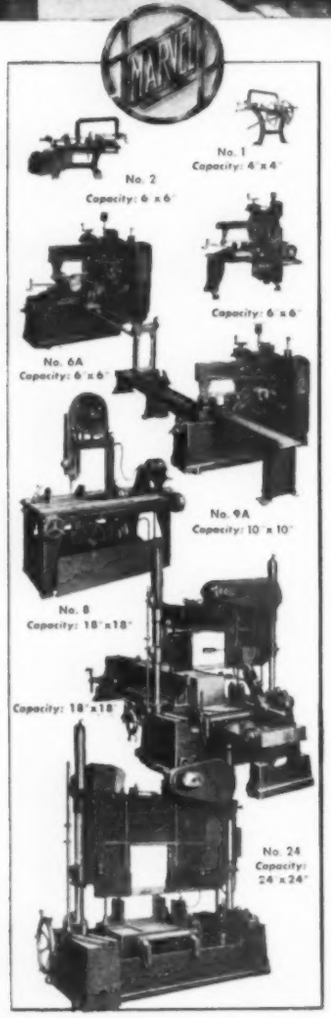
Thor PORTABLE POWER TOOLS

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS

RAILWAYS ARE *Streamlining* THEIR SHOPS TOO!

(ABOVE) MARVEL No. 9A Production Saw automatically cutting-off hollow iron into staybolts; 1" x 9", 30 bolts to the cut.

(LEFT) Cutting accurate lengths from 3½" steel tubing for spring and brake hanger bushings.



Railway shops are "re-converting", not to new products but to newer and more efficient methods.

Today, in the Paducah shops of the Illinois Central, for example, much cutting-off work is being done with MARVEL No. 9A Production Saws that feed, measure and cut off identical lengths automatically with no more operator attention than is required by an automatic screw machine.

Operating "automatically", the MARVEL No. 9A Saw illustrated above has cut-off as many as 300 pieces of 1" round staybolt stock in a single hour. Supervision at the Paducah shops tell us that the machine paid for itself in the first 30 days and has been piling up dividends ever since. These extremely accurate and fast saws are not limited to production cutting-off work, because at any point in a "run", the automatic bar push-up can be dis-engaged, a miscellaneous cut made, and the production run resumed by merely re-engaging the bar push-up clutch.

The MARVEL System of Metal Sawing comprises 9 different types of metal-cutting saws; provides the complete answer to most metal sawing problems.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**

***Eastern Sales Office:* 225 Lafayette St., New York 12, N. Y.**

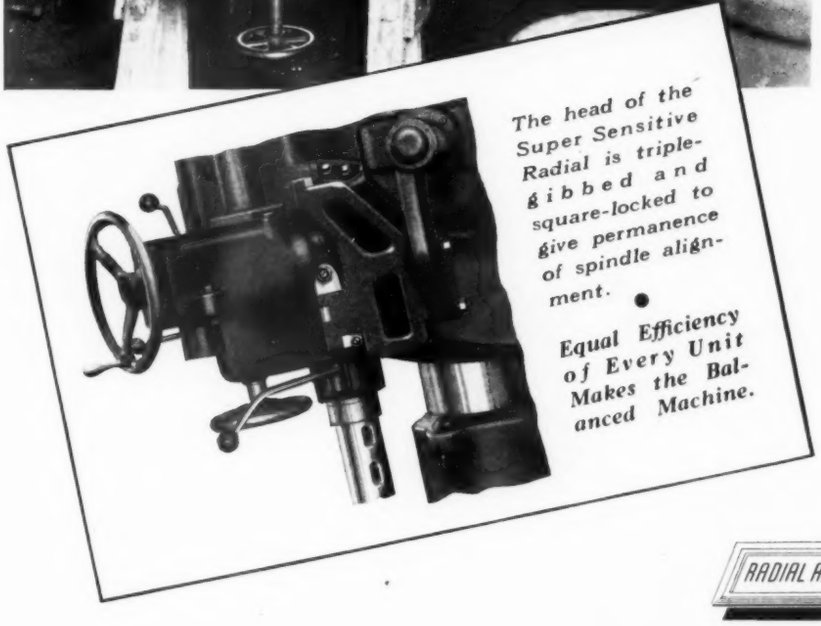
MARVEL SAWS

A NEW JOB EVERY DAY...

It must be versatile, it must be powerful, easy to handle and accurate, to meet the varied requirements in the railroad shop.

Here this Cincinnati Bickford Super Service Radial is drilling a 3" grease cup hole in a tough steel fork end-type main rod. The same machine also taps the hole.

Write for detailed Bulletin R-24A.



The head of the Super Sensitive Radial is triple-gibbed and square-locked to give permanence of spindle alignment.

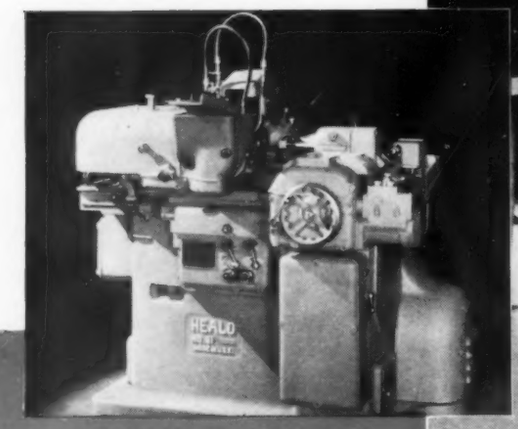
●

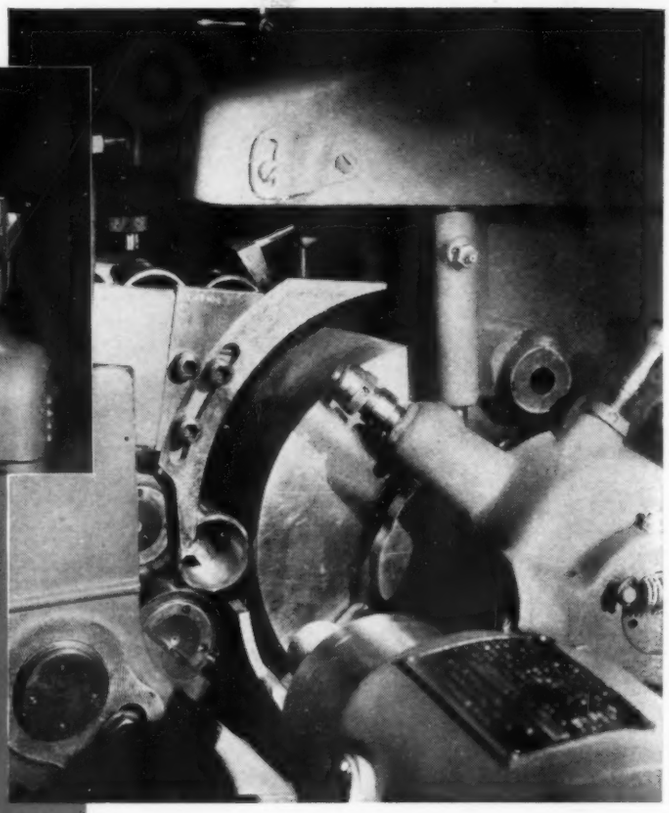
Equal Efficiency of Every Unit Makes the Balanced Machine.

See our condensed catalog in Sweet's File

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9. Ohio U.S.A.





FOR FINER FINISH

use the right grinding oil

GET

★ More Production

★ Longer Wheel Life

★ Less Scrap

REGARDLESS of the metal or type of grinding, Texaco oils assure all the benefits listed above, plus these additional advantages:

1. *Cool the work quickly,* preventing distortion from high frictional heat.
2. *Prevent loading* of grinding wheel, promoting faster cutting.
3. *Settle grinding dirt quickly.*
4. *Protect finished surface* from rust and corrosion.

Especially notable results are being obtained by operators using Texaco for internal centerless grinding of ball and roller bearing races — a typical example of the way Texaco cutting fluids improve *all* forms of metal cutting.

For Texaco Products and Enginering Service, call the nearest of the more than 2300 Texaco distributing plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO CUTTING, SOLUBLE AND HYDRAULIC OILS FOR FASTER MACHINING

TUNE IN THE TEXACO STAR THEATRE WITH JAMES MELTON SUNDAY NIGHTS ★ METROPOLITAN OPERA BROADCASTS SATURDAY AFTERNOONS

Communal Management

THERE is one country in which unions have gained control of management of industrial plants.

They do not actually administer the business. But they exercise a veto power over management. The latter does not make any move without first consulting the union committee and securing its consent.

If management thinks it wise to invest in new equipment, it cannot proceed until the union agrees.

The union has a hand in every kind of program involving expenditure of the company's funds. It goes so far as to examine, or have access to, the company's books. Inspection extends to such minor matters as officials' expense accounts.

In effect, management's hands are tied. An executive can scarcely leave his office to wash his hands without asking union permission.

Sounds like a fairy tale, doesn't it? But it is a true story, and the country is France. The tale comes from the lips of French industrialists visiting America.

The trend toward this amazing situation started more than a decade ago. The "sitdown" strikes in French factories were the first open manifestation to startle the world. France, you may recall, had the dubious honor of having originated the "sitdown."

By 1939 the encroachments by unions upon management's functions and the indifferent attitude of workers toward their jobs had reached a shocking stage. In France's hour of peril, French plane production was almost completely demoralized.

All of us know what happened to France. Now that France once again is a free country, French industry is having extreme difficulty getting back into production.

Food is short, and workmen spend a considerable part of each working day foraging for food for their families. Power and other facilities are inadequate. There are shortages of everything.

On top of these extraordinary troubles are piled the rules and regulations of the unions that make the task even harder.

We ask anyone with only a smattering of knowledge of how industry operates, "How can French industry hope to stage an effective comeback under such impossible conditions?"

It may not be amiss for American union leaders who are ambitious to help management run our industries to study what happened to France. In their eagerness to expand their power, some of them go far beyond the bounds of collective bargaining as envisaged in the Wagner Act.

For the sake of their own members, and in behalf of their own welfare as well as of the nation's welfare, they should "take it easy." President Phil Murray of the C.I.O. recognizes the danger of doing otherwise. He is reported to have ordered his lieutenants to stop tampering with our economic system and stick to the "more pay" issue.

America is big and powerful. Our industrial system is the envy of all other nations. It will continue to hold its leadership, however, only as long as the two human factors that comprise it—management and labor—recognize and respect each other's rights and do not try to preempt each other's functions. Each has an important job to do without stepping over into the other's field.

Surely every one of us will be the loser if we emulate France.

Burnham Finney

INSTRUCT THEM . . .

ON A CINCINNATI SHAPER !

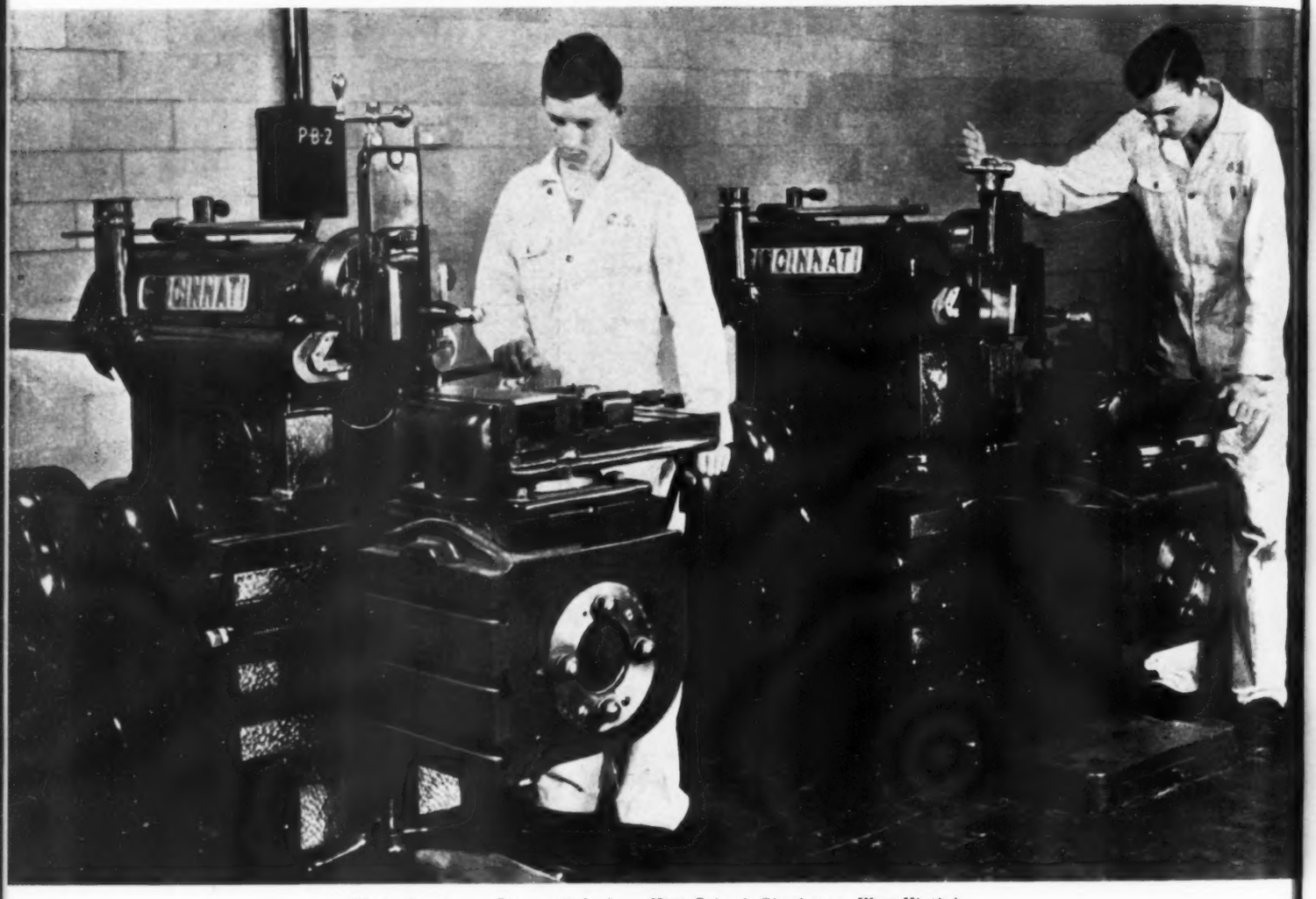


Photo Courtesy: Stonewall Jackson High School, Charleston, West Virginia

The student should learn on a modern Shaper, such as he will operate in industry. Modern Cincinnati Shapers are found in batteries in large plants or singly in the small shop throughout the world.

Write for Cincinnati Shaper Catalog N-2 and educational bulletin "Set-ups on Cincinnati Shapers".

THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

How NOT To Go Broke on Setup Costs

BY GREGORY J. OBERST, PLANT ACCOUNTANT, ELASTIC STOP NUT CORPORATION OF AMERICA

With wartime volume in the past, manufacturers are faced with the problem of making low-cost parts in anticipation of orders. This calls for finding machine runs that will absorb setup costs

ANYONE knows that making setups which cost more than the selling price of the run is a sure way of going to the poorhouse, if done often enough. But the temptation to overlook this sober fact is strong just now with companies that make items of comparatively low unit cost. Wartime volume is gone. Old customers want quick service on peacetime lots. New customers would like to try a dozen units. The manufacturer of l.u.c. items must oblige promptly if he is to hold his market and grow. What to do? The answer to the manufacturer in this fix is fairly simple, but he must be prepared to struggle with figures. Steps are:

First, he must make up his mind not to fill orders from specific setups, except in unusual circumstances.

Second, he should decide to manufacture in economical quantities in anticipation of demand.

Third, when the postwar situation clears, he may find it advisable to manufacture against closely estimated consumption, and thereby enjoy the benefits of stabilized operations and employment.

For the present, assume that point 2 is the goal. A practical approach is the establishment of minimum runs for the various items in the line. In a sense, a minimum run is an economic lot size, but the figure is not arrived at in a strictly textbook manner. In actuality, a minimum run is that quantity of pieces which will absorb setup costs within practical limits, and provide a total factory processing cost upon which a planned profit can be made.

Suppose items are sold for so much per 100. The elements of the selling price are material, setup cost, factory processing cost, commercial cost and profit. The object is to control the first four factors in order to realize the fifth. Because setup costs are so important, the curve shown in Fig. 1 can be plotted to ascertain the effect of setup cost on total factory processing cost per 100 items at various runs.

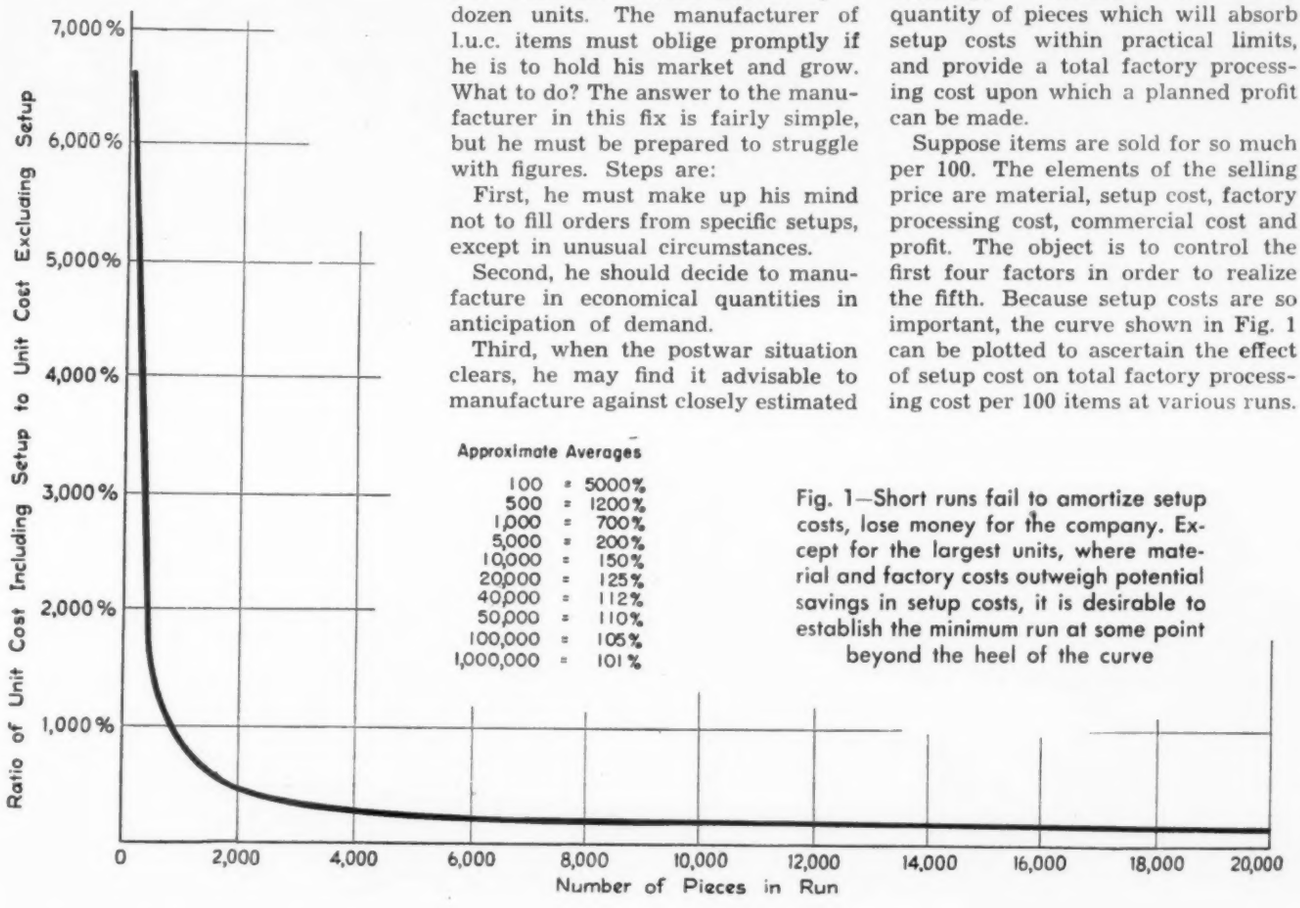


Fig. 1—Short runs fail to amortize setup costs, lose money for the company. Except for the largest units, where material and factory costs outweigh potential savings in setup costs, it is desirable to establish the minimum run at some point beyond the heel of the curve

Suppose when the run is extended from 100 to 50,000 pieces, the total factory costs may drop from 5000% to 110% of ultimate because of amortization of setup cost. When the run is extended from 50,000 to 1,000,000 pieces, the unit factory cost may be reduced to only 101% of the ultimate for the same reason.

Location of Minimum Runs

In checking such curves (a curve should be established for each item in the line) it may be found that a unit factory cost 110% of ultimate will occur at 30,000 to 40,000 pieces, except for the smallest and largest items. Cross-hatch this area on the curves, as in Fig. 2, to draw attention to the location of minimum runs. Of course for the largest items in a line, the minimum run can be shortened, because the setup cost is proportionately less on a unit basis.

By programming the work through the shop and being careful of the scheduling sequence so as to hold tool changes and setups to a minimum, further economies can be effected. For example, if a screw machine is running 9/6-in. hex steel bars, the shop will attempt to put it next on another 9/16-in. hex steel job in order to avoid changing collets, pushers and other elements.

The method of production has an important bearing upon the cost of 100 pieces. Fig. 3 shows a study of three methods for making one item. The solid line shows one shop approach to making the item in various quantities. That is, from 0 to 300 pieces, method *A* might be employed; from 300 to 10,000 pieces, the shop would use method *B*, and from 10,000 pieces and up—method *C*. By determining the curve mentioned previously, it is seen that some errors of amortization of setup cost can be introduced by these practices. It would be proper to eliminate method *A* and possibly method *B*, although method *B* could be used for runs from 100 to 1700 pieces and method *C* for runs above 1700 pieces.

Minimum runs have an important influence upon successful conduct of any business when setup costs are large in relation to unit processing cost. In any enterprise, price schedules are developed through competition, custom and cost. In respect to setup cost, let us analyze the pricing elements. Suppose that we know that the cost of material, the machine cost, the factory overhead, the commercial overhead and the profit on 100 units of a given size total $1. Everything has been considered here, except the setup cost. Now suppose that the selling price is $1.50 per 100 units. Further, assume that the cost of setting up is $50. Then the maximum allowable setup cost per 100 pieces is $1.50 minus $1, equals 50 cents. The minimum number of parts to be run to realize the investment in setup cost then is $50 divided by 50 cents equals 10,000 pieces. This process can be used for determining the minimum length of run when there is a fixed selling price.

In practice, costs change over a period but the selling price may be fixed. Again find the sum of the processing cost and the commercial cost plus the profit expected, excluding the setup cost. Subtract this sum from the selling price to determine the net amount available for setup per 100 units. Thereupon, the minimum size of run is equal to the setup cost divided by the unit setup cost.

Minimum Runs vs. Profit

Obviously, the minimum run is affected by the percentage of profit that the manufacturer is willing to accept under a fixed selling price. If he sets the percentage of profit low enough to maintain a healthy position but not invite competition, more of the selling price is available for unit setup cost. Often it will be found that the percentage of profit varies directly with the change in minimum run, particularly when small sizes of products are considered.

If the manufacturer is free to establish the selling price, the effect of setup cost can also be determined. Fig. 4 shows the method. For each size of item, the selling price exclusive of its setup component is stepped off on the proper vertical lines. The top line represents the selling price per 100 units, when the minimum run is set, for example, at 10,000 pieces. The second line represents the selling price when minimum

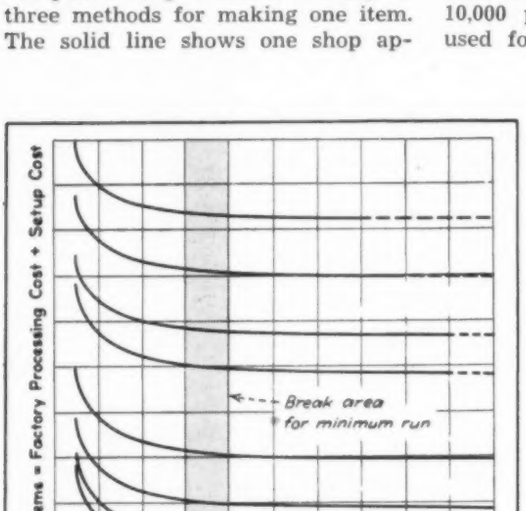
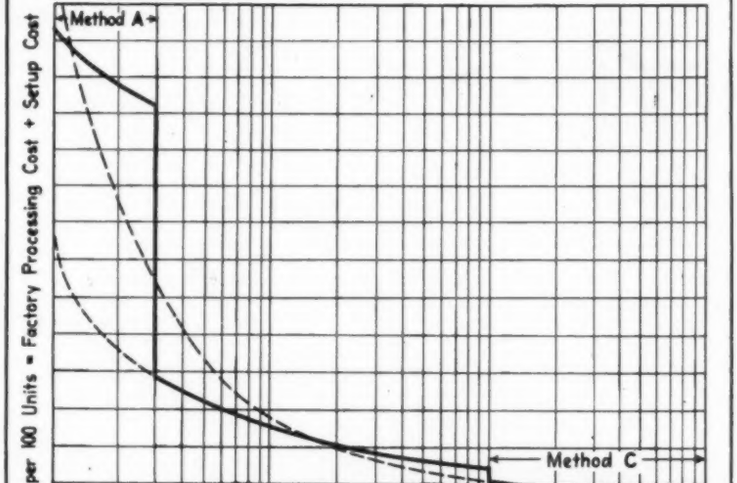

Cost per 100 Items = Factory Processing Cost + Setup Cost
Break area for minimum run
0 10 20 30 40 50 60 70 80 90 100
Size of Run — Thousands

Fig. 2—The cost per 100 units at various lengths of run can be plotted for all items in a given line. Shaded area shows location of minimum runs

Fig. 3—Minimum-run data may influence shop methods. The solid line shows the break points established by custom for three methods; the dash lines indicate methods which produce lower costs per 100 units


Method A
Method B
Method C
Cost per 100 Units = Factory Processing Cost + Setup Cost
100 200 300 1,000 3,000 10,000 30,000 100,000
Size of Run

runs established by the curves are used. And of course the third line represents the selling price when runs are so long that the setup cost per 100 unit drops to an infinitesimal amount.

The importance of amortization of setup cost through determination of proper run sizes is also shown by this curve. The planned profit for the specific item can be realized if the selling price can be fixed for the calculated amount.

A Check on Setup Costs

To control amortization of setup cost, an Operation Cost and Inventory Record, Fig. 5, is helpful. For each operation on a specific part, the periods for setup, machine time and idle time are posted in hours and tenths of hours. Setup costs equal the setup time multiplied by the setup rate; the operating cost equals the machine rate times the operating time. Under debits are shown the pieces produced. The figures on this example show that the setup cost amount to $0.007 per 100 units. This cost can be compared with the standard.

A convenient method of analyzing setup costs is as follows: Once a month make an analysis of burden absorption, whereupon excessive setup costs become apparent immediately. The analysis is made simply by transferring all setup charges on the cards, in this case $24, from the factory burden account to a setup cost or burden account. Now suppose we summarize thus:

Manufacturing expense	$500,000
Absorbed in production	250,000
Absorbed in setup	200,000
Total absorbed	450,000
Unabsorbed manufacturing expense	50,000

If the analysis shows that the setup expense is not in proper ratio to manufacturing expense for the period, the Operation Cost and Inventory Record cards can be studied to see which operations are giving trouble.

The Operation Cost and Inventory Record card has debit, credit and balance columns which give a perpetual inventory of pieces at the operation. Make entries in the credit column for pieces that pass inspection and go to the next operation. Suppose at a given time a balance of 31,000 pieces is on hand after the operation stated, and that the standard cost is to be changed from $1.0007 to $1.000. The inventory record was charged at $1.007 and now the cost accountant wants to change the record to an inventory price of $1.000 per 100 pieces.

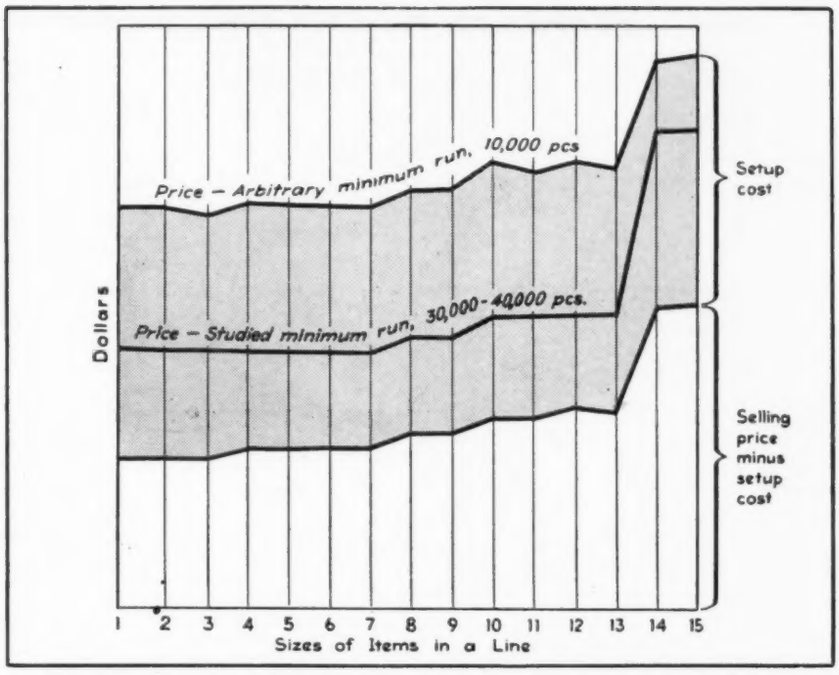

Price – Arbitrary minimum run, 10,000 pcs
Price – Studied minimum run, 30,000-40,000 pcs.
Setup cost
Selling price minus setup cost
Dollars
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Sizes of Items in a Line

Fig. 4—In a free-price market, a manufacturer can adjust his minimum runs to quantities that yield a setup cost equal to the difference between the desirable selling price and the sum of material, factory and commercial expenses plus profit. The chart also shows the extreme effect that setup costs can have on selling prices

The difference, $2.17 for 31,000 pieces, is written off as an inventory adjustment due to changing standards.

The underlying cost data for operating on the minimum-run plan is more conveniently derived by the machine-rate method than by the labor plus overhead method of cost accounting. The machine-rate method is preferable because it produces more direct and accurate cost figures with respect to individual operations. The reader may ask why. The answer is this: The product of one machine or facility is sold to a specific customer without any relationship to what is coming off a similar but different machine; that is, one which differs in size or make, because these factors affect production rates and costs. If the labor plus overhead method is used, there is a tendency to level the burden over all operations within a production cost center or department. But by using the machine-rate method, many cost elements can be made direct rather than indirect cost elements. An example of this can be shown by Tables I, II and III.

All of the figures in these three tables will be the result of dividing a normal series of cost elements, which had previously been allocated to individual machines, by the corresponding normal hours.

The normal hours are defined as follows: For each machine center (group of like sizes and kinds of machines) the total number of machine hours normally available for production in one year can be determined. These normal hours are the actual number of hours during which production can or will be run. Having determined the total number of normal hours in a machine center and the total normal cost including a proportional share of the general overhead, it is possible to determine the normal machine rate for the machine center.

With the normal standard operating cost of each machine per hour known, it is possible to determine the standard processing cost, provided the average yield of the machine in pieces per running hour is known. The non-productive time factors which one may expect are:

1. Plant is idle—normal unscheduled capacity (accounted for in normal shop level, and therefore in machine rate).
2. Down time for repairs, maintenance, lost time, faulty tools (accounted for in the machine rate).
3. Time spent on setup (accounted for in the machine rate).
4. Personal fatigue and delay time (accounted for in yield per hour).
5. Operator inefficiency (accounted for in yield per hour).

Table I—MACHINE COST PER HOUR WHILE RUNNING

Labor Overhead		Machine Rate Method			
		Machine A		Machine B	
Labor Rate	$1.22		$1.22		
Burden (at 850%)	10.37	Tool Cons.	3.85		5.10	
		Repairs	.79		1.40	
		Fixed Charges	.66	$6.52	1.16	$8.88
		Operating charges:				
		Lubricants	.11		.11	
		Power	.11		.22	
		Sundries	.05		.05	
		Scrap	1.09	$1.36	1.09	$1.47
		Other burden factor		3.03		3.15
Total	$11.59	Total		$10.91		$13.50

These figures show the advantage of the machine rate method of calculating factory costs per machine. Machines *A* and *B* are both large, heavy machines, their tool cost consumption per hour is high. The operating fixed charges and other burden factors are not similar. Elements of overhead in the 850% can be detailed and allocated to individual machines by the machine rate method, but this is not practical with the labor plus overhead method.

Table II—COSTS WHILE MACHINE IS BEING SET UP

	Method		
	Labor *Plus Overhead	Machine Rate	
		Mach. A	Mach. B
Labor	.....	$2.08[1]	$2.08[1]
Fixed charges	.....	0.66	1.16
Gen'l Burden	.....	0.52	0.52
Total	.....	$3.26	$3.76

*Not known, is part of 850% burden applied to labor cost in Table I.

[1]Includes supervision, operator's proportionate idle time, payroll taxes, workmen's compensation and shift premiums.

TABLE III
IDLE MACHINE RATES

	Machines	
	A	*B*
Non-variable:		
Labor.....	$0.09	$0.09
Supplies.....	0.01	0.01
Maintenance..	0.01	0.01
General burden	0.89	0.89
Fixed charges....	0.66	1.16
Total idle rate...	$1.66	$2.16

Further understanding of this matter can be gained from examining Fig. 6, "How a Calendar Shrinks to a Net Productive House." Segment 1 represents the hours in a year.

Segment 2 shows the percentage of this time which is lost due to normal idle capacity; Segment 3 shows the remaining hours which are available to the manufacturing division. However, manufacturing needs a certain number of hours, Segment 4, for non-productive purposes, that is, to keep the machine repaired and allow operators time off for first aid, unusual trouble, including rework. Segment 5 represents the time required for manufacturing to set up the job and to break it down and is used to develop the setup rate. So we come to Segment 6 which represents normal hours of production, and it is this segment which is used to determine the running rate.

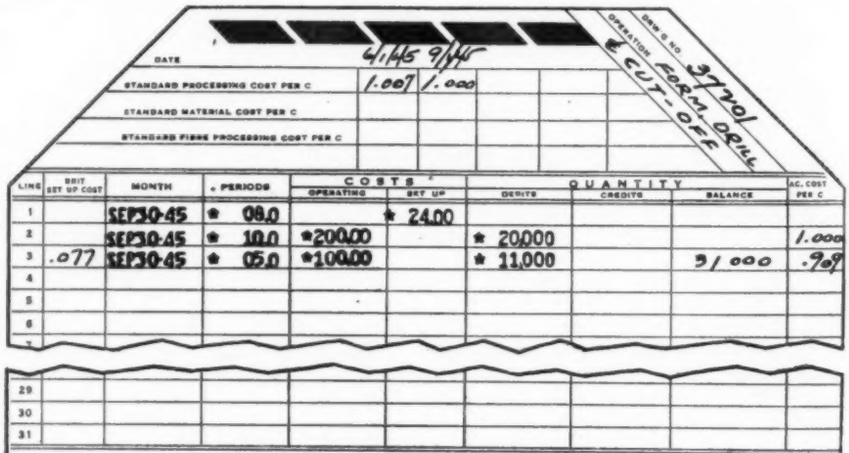
Non-variable cost components of the machine rate are determined by dividing the non-variable cost elements by the sum of segments 5 and 6 in terms of hours. These non-variable components are then uniform whether the machine is running or being set up. If the normal hours of utilization fall below the sum of segments 5 and 6, idle capacity develops. Then the idle rates are used to develop the idle costs.

Variable Costs

Variable costs are of two kinds: (a) those that apply to setup and (b) those that apply to running time. To determine the variable running time cost, divide by segment 6; to determine the variable setup cost divide by segment 5. Then the total running rate is equal to the variable running time rate plus the non-variable rate and the total setup rate is equal to the variable setup rate plus the non-variable setup rate. The cost of idleness is the non-variable rate.

This is a broad statement of derivation of rates. In actual practice only a known portion of the non-variable rate applies to the running rate. Obviously non-variable maintenance cannot be carried into the setup rate.

The determination of rates ends with segment 6. The question of efficiency in use of the machine now enters the picture. There are two factors affecting machine efficiency: The first consists of time losses that are inherent in a job; that is, one job



OPERATION COST AND INVENTORY RECORD

Fig. 5—An Operation Cost and Inventory Record for each operation serves as a control measure. It gives the setup cost, total machine cost per run and output, plus a summary of pieces that pass inspection. Each month the setup costs can be transferred to a setup burden account and a study made to see where such costs have not been absorbed

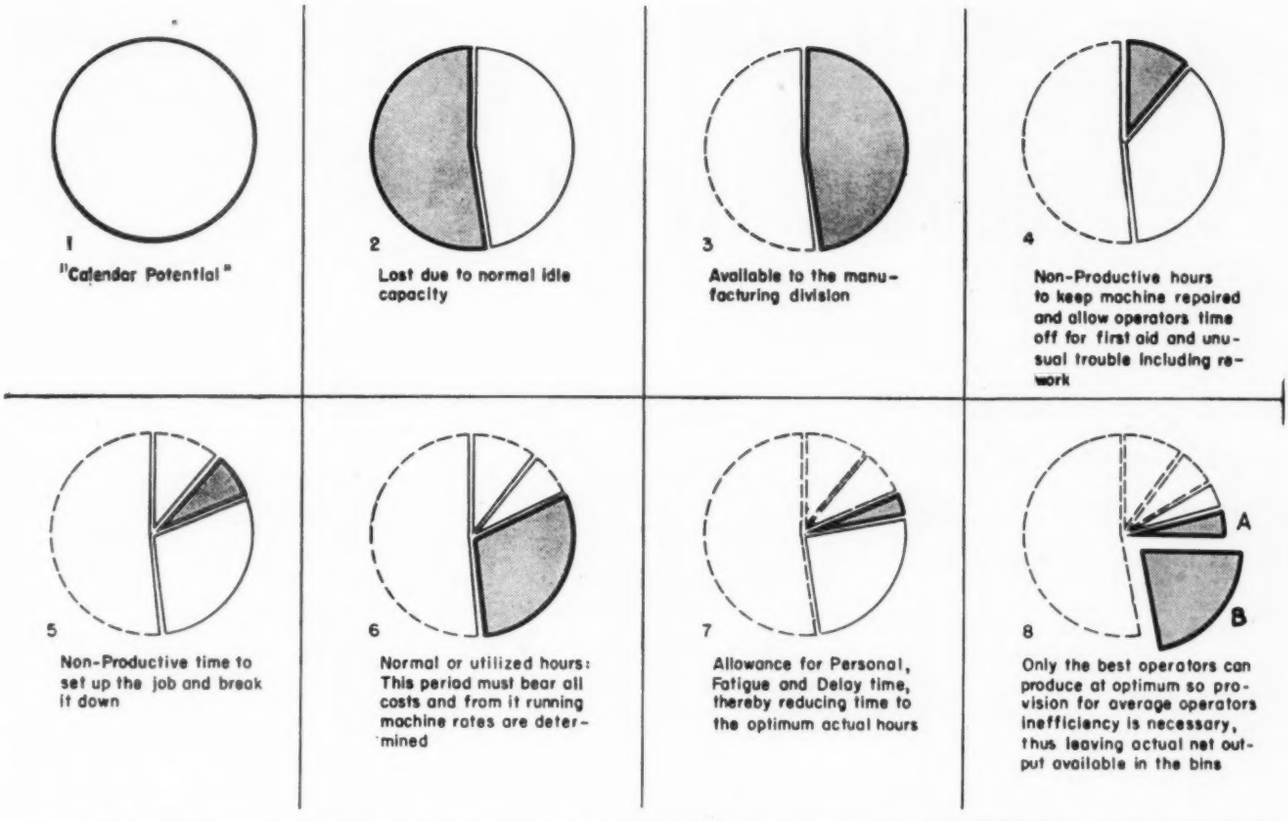

1
"Calendar Potential"
2
Lost due to normal idle capacity
3
Available to the manufacturing division
4
Non-Productive hours to keep machine repaired and allow operators time off for first aid and unusual trouble including rework
5
Non-Productive time to set up the job and break it down
6
Normal or utilized hours: This period must bear all costs and from it running machine rates are determined
7
Allowance for Personal, Fatigue and Delay time, thereby reducing time to the optimum actual hours
8
A
B
Only the best operators can produce at optimum so provision for average operators inefficiency is necessary, thus leaving actual net output available in the bins

Fig 6—The machine-rate method of cost accounting is required in order to produce more reliable cost figures for each operation, and thereby permit derivation of true factory and setup costs in making a specific item. This chart illustrates how the calendar hour shrinks to a net productive hour for cost purposes

is more fatiguing than another or there are delays for changing tools, loading bars and the operator's personal time (Segment 7). This is the portion of Segment 6 in which production is lost but it cannot be worked into the rate because it is inherent in the job and not the machine.

The second factor concerns matters inherent to the operation (Segment 8). Segment 8*A* is an allowance for personal inefficiency, whereas Segment 8*B* represents the actual output per hour. This cannot be included in the rate because it is variable with the operator.

With these facts in mind the plant can turn to the process routing sheets, which show the optimum hours per 100 pieces. The cost department must then apply Segment 8 from an overall point of view. In general, the cost department knows from past performance the operator efficiency, which is easily determined from incentive records. To the hours on the process sheet the cost department adds a factor for operator inefficiency. These hours per 100 pieces are multiplied by the machine running rate for each operation to determine the unit standard cost of 100 pieces, that is, for a specific operation. The operational cost on the part is the sum of the unit standard costs of all operations on the routing sheet.

The setup cost is also determined from a route sheet; that is, the standard setup hours are multiplied by a standard setup rate (for each operation). The total setup cost for the part is determined by adding the cost of all setup operations. Now the unit cost of the operation and the total cost of setup have been determined. The material cost is determined in the conventional manner.

Total factory cost curves can be developed by calculating the total cost for runs of 5000 to 100,000 pieces. Suppose the total setup cost equals $100 for the part. Then to produce 5000 pieces the setup cost equals $100 divided by 5000, equals $2 per 100 pieces. The same type of calculation is carried out with respect to other quantities and enough of these calculations are made so that the factory cost curve, Fig. 2, can be drawn smoothly. The curve for the equation is

$$\frac{SU}{SR} + UPC + UMC = \text{Factory cost}$$

per 100 pieces for size of run indicated.

Where: SU = Setup cost
SR = Size of run
UPC = Unit processing cost
UMC = Unit Material cost

An examination of this equation shows that the expression SU/SR is dominant when the quantities are small.

Curves can be developed for all of the items in a given line and, if necessary, these can be correlated with similar products. That is, if the curves are developed for steel items, it is possible to associate similar curves for brass items of equivalent sizes for "horizontal" comparisons.

All figures and charts given in the foregoing discussion were developed purely for illustrative purposes. But it has been shown that: (1) minimum runs can be determined within practical limits by graphical means; (2) amortization of setup cost can be traced, and (3) the machine-rate method of cost accounting produces more direct and accurate figures with respect to individual operations. Perhaps forward-thinking managements will find the principles discussed of value in future planning.

GENERAL RULES FOR POWDER METALLURGY

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The effects of processing on the physical properties of compacts of metal powders are reduced to thirteen trend charts

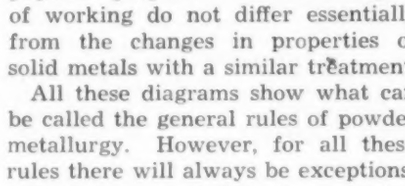
THE PHYSICAL and engineering properties of powder-metal products depend mainly on the state of the compacts and on the history of their processing. Compressed metal powders, not subjected to any heat-treatment, have quite different properties compared with compacts subjected to heat-treatment (sintering). The compacting pressure has a dominating influence on the properties of the compact. However, metal powders compressed at elevated temperatures differ considerably in their properties from those compacts compressed at room temperature and heat-treated afterwards. The final qualities of a powder-metal product are determined by a great number of variables, such as the basic material used, the particle size of the powders, the compacting pressure, sintering temperature, sintering time, sintering atmosphere, subsequent working, etc.

Powder-metallurgical experience, however, allows the predetermination of the physical and engineering properties of the finished product at least to a certain extent, although the great number of variables seems to make any predetermination of properties of the compact very difficult.

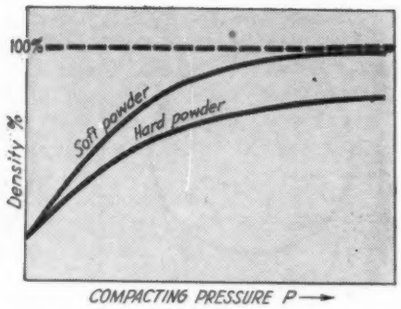
In these diagrams, an attempt is made to generalize the trend of properties of compacted metal powders and to show their dependence on the processing steps. It is self-evident that all physical properties are influenced also by subsequent working of the compact after sintering. Cold or hot reduction, such as repressing, drawing, or hot hammering, will always increase the density, hardness, tensile strength, etc., whereas elongation of the compact will generally decrease with the degree of working. Annealing compacts will hardly affect density but decreases hardness and tensile strength and increases elongation to a great extent. These changes of physical properties with the degree of working do not differ essentially from the changes in properties of solid metals with a similar treatment.

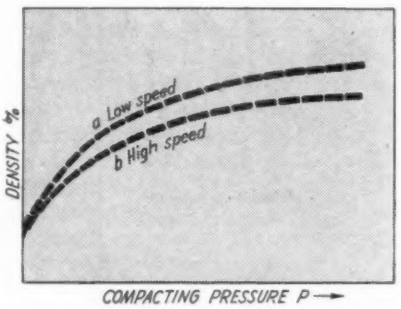
All these diagrams show what can be called the general rules of powder metallurgy. However, for all these rules there will always be exceptions, and for many materials the exception will be even the rule itself. Despite these restrictions, the above information is correct enough to give a general picture on the effect of processing trends on the physical properties of metal-powder compacts.

1. Compact density decreases as particle size increases. Regardless of the type of basic material, high density of the compact can be obtained with fine metal powders and density decreases as grain size becomes coarser—assuming other variables, such as compacting pressure, sintering temperature and time, etc., remain constant.

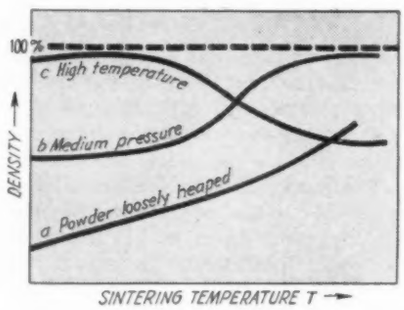


2. Higher density results from powders of softer metals. While it is difficult to generalize the effect of the basic material and combinations on compact density, if other variables of processing remain constant a higher density of compact can be obtained from powders of soft metals than from hard. Further, increasing the compacting pressure increases the density of the compact.

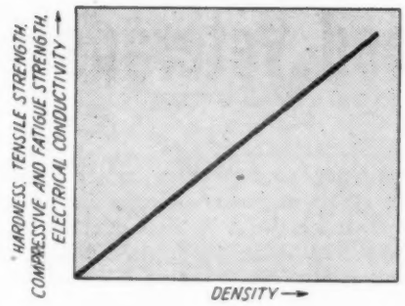




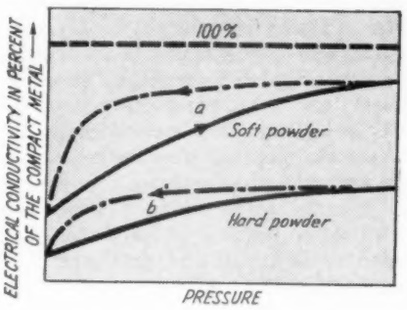
3. Variation in pressing speed affects density but little. Compacts pressed at high speed usually show a decrease in density, as compared with compacts compressed slowly, as a result of deformation of particles and of absorption of pressure energy by friction between particles.



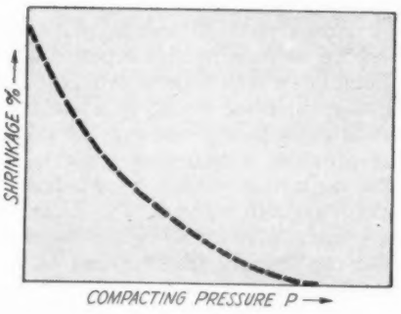
4. Optimal compacting pressure should correspond with material and sintering conditions. Sintering temperature affects compact density as here shown, compact density of course being greater when the metal powders are compressed before sintering. Metal powders, loosely heaped and sintered, are agglomerated into a compact (a) of density increasing with sintering temperature. Compressed or compacted powder will likewise have a density which increases with sintering temperature (b) as long as compacting pressure is not too high. When pressure is too high, however, density will be inversely proportional to sintering temperature (c).



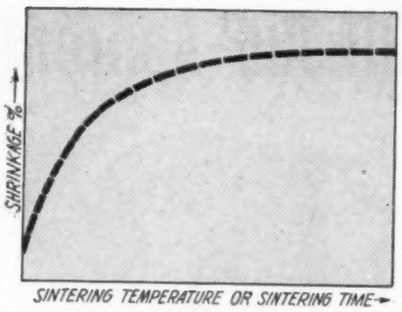
5. Increased density improves physical properties. Diagrams 1 to 4 show density of compacted materials as a function of the material and the pressing conditions. In many cases and for most materials, increased density increases hardness, tensile and compressive strengths, fatigue strength, electrical conductivity and other physical properties directly—even in linear proportion as shown.

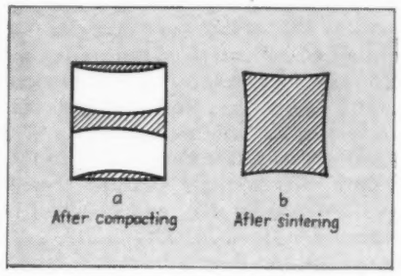


6. Electrical conductivity increases with increased compacting pressure. Higher compacting pressure creates more contact surface areas between powder particles. Soft-metal powders come into contact with less pressure than hard, of course. Here electrical conductivity is shown as a function of the pressure to which the compacts (compressed but not sintered) are exposed. Conductivity is higher when pressure is decreasing rather than increasing.

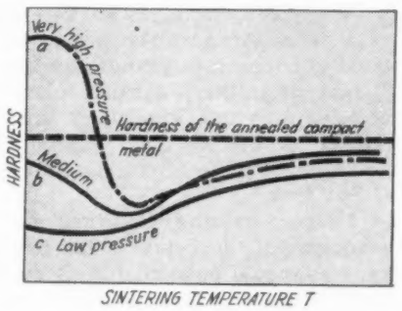


7. & 8. Density of a sintered compact depends upon shrinkage during sintering. Predetermination of shrinkage is one of the most important, and most complicated, tasks in powder metallurgy. Final dimensions and physical properties of compacts depend principally on the shrinkage, which is inversely proportional to compacting pressure, as at lower left, and directly proportional to temperature and time of sintering, above.

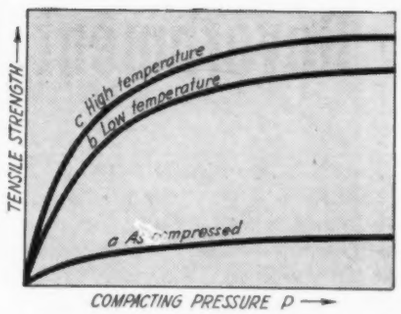




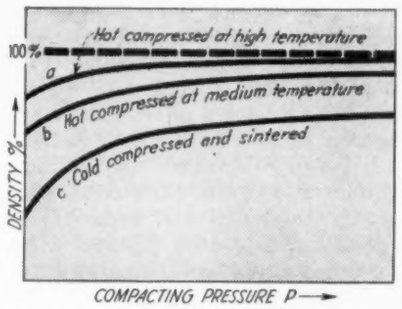
9. Percentage of shrinkage differs according to pressure distribution. In this typical large cylindrical compact, pressure distribution in the compressed but unsintered section is shown at *a*. Hatched portions are zones exposed to lower compacting pressures and therefore of lower density. The same compact, after sintering, is shown at *b*, with shrinkage exaggerated.



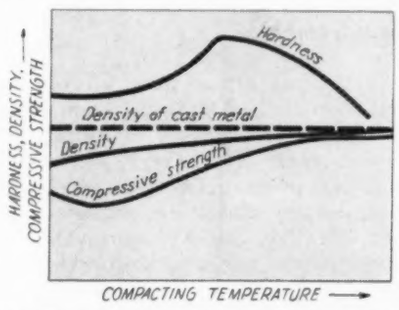
10. Hardness of a sintered compact depends on compacting pressure and sintering temperature. Metal powders compressed at low pressures usually show an increase in hardness as sintering temperature increases (c); if compressed at medium pressure, hardness will decrease as temperature is increased up to a certain point, then tends to increase again (b), if compressed at very high pressure, hardness of the sintered compact will surpass the hardness of the annealed solid metal at low sintering temperature, but hardness goes down rapidly then rises slowly as sintering temperature is increased (c).



11. Tensile strength is directly proportional to compacting pressure and sintering temperature. Even green compacts, not exposed to any heat-treatment, show a certain, but low, tensile strength (a). Low-temperature sintering (b) gives lower tensile strengths than high-temp. sintering (c) as compact pressure increases.



12. Density of hot-pressed compacts is directly proportional to compacting pressure and pressing temperature. Initial pressing is usually done at room temperature, but during the last few years compressing at elevated temperatures has been developed. It eliminates sintering and controls shrinkage. Density of a compact pressed at elevated temperature and not sintered is greater than the density of the same material compressed at room temperature, then sintered. Here a cold-compressed and sintered compact (c) is compared with a compact of the same material compressed at medium temperature (b) and at high temperature (a).



13. Compressive strength and hardness increase as compacting temperature increases, but hardness reaches a maximum, then declines. The maximum density of powder-metal products is equal to cast-metal density, regardless of compacting temperature.

Government Will Aid Apprenticed Veterans

APPRENTICE TRAINING of war veterans, on a very flexible basis, is now possible as a result of recent changes in the Servicemen's Readjustment Act of 1944 (Public Law 346). This law, popularly known as the G.I. Bill of Rights, now provides increased subsistence allowances. Other regulations also have been liberalized to permit "on-the-job" training. As a result, business and industry have the opportunity to attract promising and responsible young men to plant and departmental jobs, despite low starting salaries.

The "on-the-job" training provisions provide the veteran with an opportunity to train for a civilian trade or position by offering him a substantial subsistence allowance while learning, and by having the employer outline a plan of training which must be approved by a designated state agency (Department of Labor in N. Y., Board of Education in Mass., etc.). The subsistence allowance—$90 maximum for married veterans and $65 for unmarried veterans — increases the veteran's salary level, as it is added to, and dependent upon, the salary the employer-trainer pays him.

While it provides for apprentices, "on-the-job" training must be distinguished from the more formal—and familiar—"apprenticeship" training. On-the-job training programs are approvable for all kinds of business and professions and other agencies where such programs can be successfully operated, hence the use of the term "on-the-job" and "in-service" for these programs which may or may not be "true apprenticeship" programs.

Requirements

Something more than an opportunity to pick up skill and knowledge incidental to working is demanded before approval of an "on-the-job" training program is granted by a state agency under the provisions of the bill. To achieve approval, the employer is required to provide in his plan these fundamentals:

1. The job objective should be definite and clearly stated, as the amount of subsistence allowance a veteran can receive depends on the difference between his learning wage and the wage he may expect after finishing his training. Thus, if the wage of an

apprentice machinist is $100 per month, and the wage for a journeyman is $200 a month, a married veteran who entered apprenticeship would receive $90 a month, the maximum, from the Veterans Administration as subsistence allowance. This brings his total income to $190 a month, which is as near as possible to the wage he may expect when his training is finished. Gradually, as he earns more, this subsistence allowance is decreased to maintain the total income of an experienced worker on the job he is training for.

2. The employer should designate a competent individual to supervise the training and report on the veteran's progress. This person is the point of contact with the Veterans Administration and should be familiar with the veteran's work and progress.

3. There should be a reasonably accurate time limit set for the completion of the training, as the veteran has a definite time allowance to his period of training (a year for his first 90 days of military service, plus a year for a year) and must know whether or not he may reasonably expect to complete his training within that time.

4. Proper training facilities, such as equipment, opportunity for practice, etc., should be available. Special equipment needed by the trainee, and not furnished by the employer, will be provided by the Veterans Administration.

5. Provisions for obtaining instruction in such subjects as science, mathematics, English, etc., should be made where required. Such means as vocational courses, correspondence courses, evening schools, instruction furnished by the employer, reference books, reading assignments, etc., are recommended. The Veterans Administration, in some cases, will pay for related courses in approved schools.

6. The program should be outlined in terms of a series of learning experiences and practice projects such as result in the knowledge and skills which are the objectives of the training. This is for the mutual benefit of employer and employee who will know what is involved and how much has been accomplished at any time.

7. Regular hours should be scheduled for the program, as reports of attendance and progress must be made to the Veterans Administration.

8. Wages for the learning period should be stated definitely, as commented on in Item 1.

9. The basis for required reports to the Veterans Administration are the progress records. They are the best evidence of good faith in carrying out the program.

The employer wishing to inaugurate an "on-the-job" training program must find out through the Veterans Administration in his area, the name of the state agency designated to pass on training programs, as this agency is not the same in each state. An application blank is secured from this agency, filled out and returned. The agency sends a representative to discuss the training plan with the employer. Action is taken on the application on the basis of this report, and the Veterans Administration and the employer are notified of the decision. Once the program is approved, that program may be entered upon by any veteran who is entitled to "on-the-job" training in that particular field.

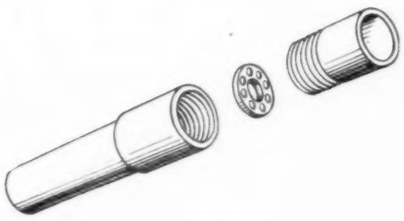
Advantages

Advantages accruing to the employer engaged in an "on-the-job" training program appear implicit. First: the subsistence allowance makes it possible for him to hire a better type of employee who otherwise might not be able to afford to accept a learner's job at a low salary. Second: the training provides a manpower source for jobs requiring special knowledge or skills, or both. Third: The training may include not only what the veteran can learn while working in the establishment, but also supplementary courses at any approved institution of learning without additional cost to the employer. Fourth: it provides a starting point for a system of job training among employers. Fifth: such a program marks the firm as giving concrete aid to returning veterans, enhancing good will.

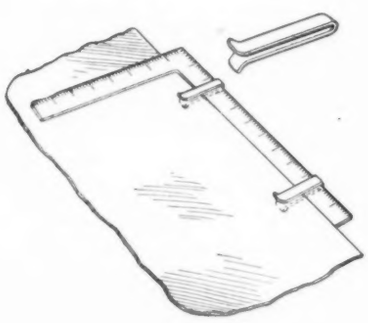
Short Cuts FOR THE SMALL SHOP

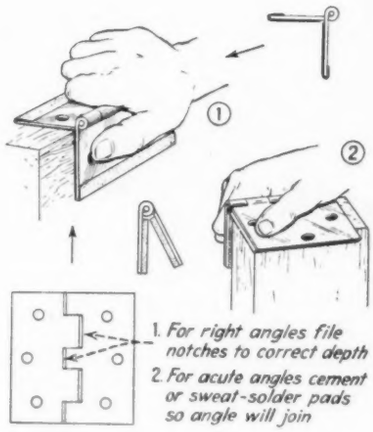
BY A. H. WAYCHOFF

NIPPLE CHUCKS can be improved easily by insertion of a ball thrust bearing. Ordinarily, close nipples for maintenance work or machine repair are made by gripping the short length of pipe in a pipe vise, threading one end, removing the piece, screwing it into a nipple chuck of the variety sketched and then threading the other end. But the turning action of the thread-cutting die screws the close nipple into the chuck, where it jams against the pipe section of the chuck. Removal of the nipple with a wrench damages the threads to some extent. But if the thrust bearing is inserted in the nipple chuck, the nipple tightens down on the bearing but can not lock, and is easily removed without damage from the wrench.

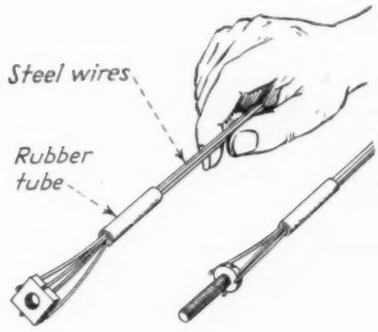


SPRING CLIPS on a metal square prevent mistakes when working thin materials. Make two clips about an inch longer than the width of the square, using heavy clock-spring material. Slip the clips on the edge of the square in contact with the edge of the sheet. The clips grip the edge of the sheet, so that the square can not slide underneath and give rise to mistakes when one wants a scribed line at right angles to the edge.



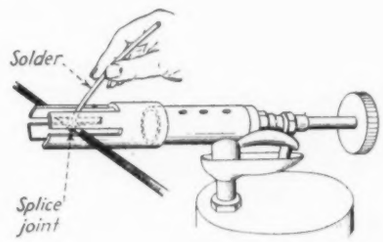


SANDPAPER HOLDERS for smoothing both surfaces of a bevel without disturbing the sharp edge can be made from large butt hinges. Cement two pieces of sandpaper of the desired grit to the hinge leaves, leaving a space between them at the hinge. With this device it is easy to smooth the surfaces of a bevel with any included angle.

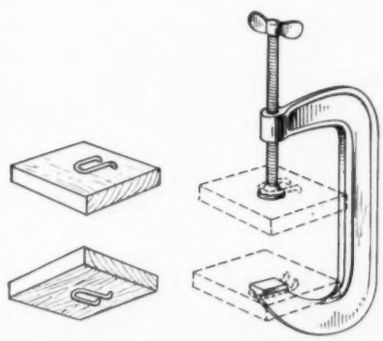


GRIPPERS for that screw or nut that can't be placed with the fingers are available in several commercial forms, but lots of people don't have them when most needed. Here is a simple solution. Take pieces of spring wire about a foot long. Slip a piece of rubber tubing over the bundled wires. Spread one end of the wires and slip in the nut or screw. Use three wires to hold screws; four wires to hold square nuts.

SPLICES in electrical wiring can be soldered rapidly by means of an attachment for a plumber's torch. Cut four slots in a piece of thin-wall tubing that fits snugly over the blowtorch nozzle. Two opposed slots should be wide; the other two should be just wide enough to receive the largest conductor commonly spliced. Place the attachment on the blowtorch nozzle so the small slots look toward the sides. In use, the splice is placed in the heating zone within the tube by pushing the stripped wires adjacent to the splice into the small slots. The operation is extremely rapid because wire solder can be wrapped about the splice before melting, or it can be fed from the top of the attachment. The tube prevents burning the insulation.



C-CLAMPS can be used upon soft material if provided with hardwood pads. For a large clamp, take pieces of hardwood about 3x3x½ in. and drive spring clips into them as shown. These clips snap over the foot of the clamp and the screw swivel and hold the pads in position while the clamp is put onto an assembly.



Basic Relationship of HYPOID GEARS

Enlarged pinions and increased spiral angle are advantages of hypoids in automotive applications. First of a series

BY ERNEST WILDHABER, GLEASON WORKS

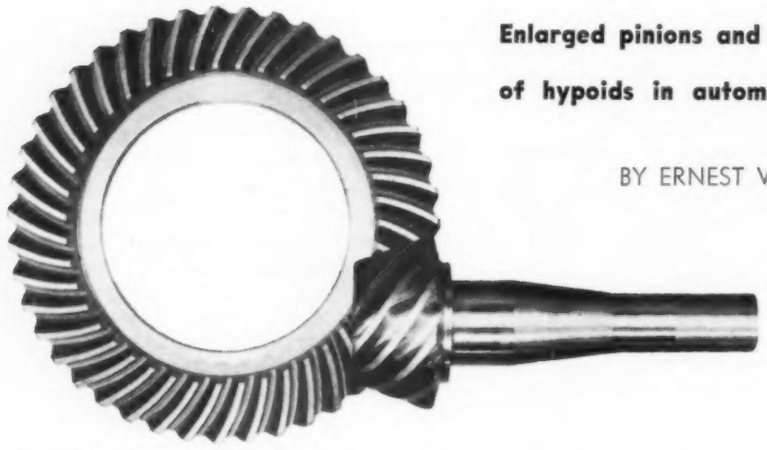


Fig. 1—Hypoid gears look much like spiral bevel gears but have offset axes

THERE are many reasons why hypoid gears enjoy such wide use in automobiles, trucks and industrial units. On automotive and higher ratios, for instance, the hypoid design gives a distinctly larger and stronger pinion and consequently a stronger drive than the bevel design. This is an indirect result of the difference in spiral angles of the hypoid pinion and gear. The normal pitch of the teeth is the same on both members and the circular pitch in peripheral direction is therefore larger on the pinion, which has the larger spiral angle. Because of this enlargement of the pinion, it is possible to attain higher reduction ratios than with bevel gears. Ratios as low as one to one are also available.

On passenger cars the lowering of the drive shaft is of value. In other cases it is important that both shafts pass each other, as permitted by the hypoid design. The increased pinion spiral angle of the hypoid design causes more teeth to be in simultaneous contact, a factor which increases smoothness of operation. In spite of the large pinion spiral angle the total resultant tooth pressure normal to the tooth surfaces is moderate, and somewhat smaller than on average spiral-bevel gears.

Hypoid gears mesh with a rolling and sliding action, although there are no lines of pure rolling, such as exist on bevel gears. All the points of a tooth surface are subjected to some sliding. There is a line or zone of lengthwise sliding of the teeth and the other points are subjected to both profile and lengthwise sliding, that is to sliding in a direction inclined to the tooth length. The action at all points of a hypoid-gear tooth surface is therefore more nearly uniform than on bevel gears or spur gears. There is no reversal of sliding at the pitch lines. This greater uniformity of sliding is favorable to lapping. In conventional automotive applications the pinion spiral angle is ordinarily 50° and the gear spiral angle about 30°. Sliding, as compared with normal displacement, is less than one third of the sliding in a worm-gear drive of 45° lead angle. This results in a high degree of efficiency when combined with proper lubrication.

Hypoid gears are the most general form of gearing and their solution has been long in coming. There is no form of gearing where so many guesses have been made, a few of them right, plenty of them wrong and some without consequence.

Relative Motion

The relative motion of two bodies, which turn on fixed axes C' and C'' at a constant ratio, will now be considered. Fig. 2 is a view along a plane parallel to both axes and Fig. 3 is a corresponding view at right angles. Offset $E = O_p O_g$ appears in Fig. 2 as the distance between the projected axes.

Relative motion is the motion of one body when the other body is stationary. It can be considered as composed of a turning motion of both bodies on their fixed axes and then of a turning motion of the whole system about the axis of one body backwards to its starting position. The resulting position of the other body then corresponds to the relative motion.

Relative motion at any one instant is a turning motion about an instantaneous axis, plus a translation without turning. Any instantaneous motion can be so described.

The turning motion changes the inclination of the various surfaces existing on the moving body. For instance, various planes may be assumed thereon for reference. The resultant inclinations are entirely independent of the translation. They can therefore be determined as if the axes C' and C'' were to intersect.

Thus, in hypoids, the direction of the instantaneous axis and the instantaneous turning motion about it are the same as for bevel gears, and can be determined by geometrical addition of the turning motions about the two axes C' and C''. Thus line OK, Fig. 4, is drawn parallel to axis C', and a distance OK proportional to the angular velocity ω' about axis C' is plotted on it. Then line KL is drawn parallel to axis C'' and the angular velocity ω'' about axis C'' is plotted at the same scale. The connecting line OL gives the direction of the instantaneous axis and distance OL the angular velocity ω_i about the instantaneous axis, at the scale used for the other angular velocities.

γ_k = angle KOL is the angle included between the directions of axis O' and the instantaneous axis OP. Γ_k = angle OLK is the angle between the directions of axis C'' and the instantaneous axis. These angles, also shown in Fig. 3, add up to the shaft angle Σ of the two axes, and will be called the kinematic pitch angles.

The kinematic pitch angles of hypoid pairs are determined like the pitch angles of bevel-gear pairs having the same numbers of teeth and the same shaft angle Σ. Formulas (1), (2) and (2a) are reproduced below, with γ_k, and Γ_k substituted for γ and Γ.

$$(1) \quad \frac{\sin \gamma_k}{N'} = \frac{\sin \Gamma_k}{N''}$$

(2) $\operatorname{ctn} \gamma_k = \operatorname{ctn} \Sigma + \frac{N''}{N' \cdot \sin \Sigma}$;

$\Gamma_k = \Sigma - \gamma_k$

(2a) $\tan \gamma_k = \frac{N'}{N''}$;

$\Sigma = 90°$; $\Gamma_k = 90° - \gamma_k$

Also

$\omega' \cdot N' = \omega'' \cdot N''$; $\omega' \cdot \sin \gamma_k = \omega'' \cdot \sin \Gamma_k$

in the same manner as on bevel gears.

The relative translation depends on the position of the instantaneous axis. At any point of line $O_p O_g$, which intersects both axes and is perpendicular thereto, relative motion is in a plane perpendicular to this line. In considering relative motion at a point O this point of the pinion moves in a direction perpendicular to pinion axis C', Fig. 3, at a rate $OO_p \cdot \omega'$, plotted as distance OG'. At the same time, point O of the gear moves perpendicular to the gear axis C'' at a rate $OO_g \cdot \omega''$, plotted as distance OG''. $G'G''$ therefore represents the rate and direction of relative motion at O, which is in addition to a turning motion about the instantaneous axis now considered passing through O.

The distances OG' and OG'' vary with different positions of the considered point O along line $O_p O_g$, and the resultant $G'G''$ varies in direction as well as amount. There is one position of point O at which the resultant $G'G''$ has the same direction as the instantaneous axis OP. Relative motion at any one instant can thus be considered a turning motion about an instantaneous axis OP and a simultaneous translation along this axis.

Distances $E_p = OO_p$ and $E_g = OO_g$ will now be determined for this position of the instantaneous axis. Referring to Fig. 3:

$$OG' \cdot \cos \gamma_k = OG'' \cdot \cos \Gamma_k$$

describes a direction $G'G''$ parallel to the instantaneous axis.

$$OG' = \omega' \cdot E_p = (\omega' \cdot \sin \gamma_k) \frac{E_p}{\sin \gamma_k}$$

$$OG'' = \omega'' \cdot E_g = (\omega'' \cdot \sin \Gamma_k) \cdot \frac{E_g}{\sin \Gamma_k}$$

$$OG' \cdot \cos \gamma_k = (\omega' \cdot \sin \gamma_k) \frac{E_p}{\tan \gamma_k}$$

$$= (\omega'' \cdot \sin \Gamma_k) \frac{E_g}{\tan \Gamma_k}$$

$(\omega' \cdot \sin \gamma_k) = (\omega'' \cdot \sin \Gamma_k)$; hence

(3) $\frac{E_p}{\tan \gamma_k} = \frac{E_g}{\tan \Gamma_k} = \frac{E - E_p}{\tan \Gamma_k}$

$E_p (\tan \Gamma_k + \tan \gamma_k) = E \cdot \tan \gamma_k$

(4) $E_p = E \frac{\tan \gamma_k}{\tan \Gamma_k + \tan \gamma_k}$;

$E_g = E \frac{\tan \Gamma_k}{\tan \Gamma_k + \tan \gamma_k}$

Through transformation:

(4a) $E_p = E \frac{\sin \gamma_k \cdot \cos \Gamma_k}{\sin \Sigma}$;

$E_g = E \frac{\sin \Gamma_k \cdot \cos \gamma_k}{\sin \Sigma}$

(4b) For $\Sigma = 90°$; $E_p = E \sin^2 \gamma_k$

$E_g = E \cos^2 \gamma_k$

The translation $G'G''$ amounts to

$$G'G'' = OG' \cdot \frac{\sin \Sigma}{\cos \Gamma_k} = \omega' \cdot E_p \frac{\sin \Sigma}{\cos \Gamma_k}$$

$$= \omega' \cdot E \cdot \sin \gamma_k$$

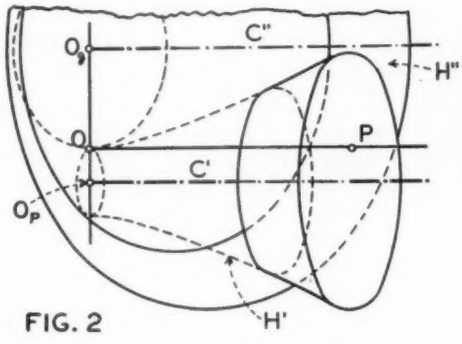


FIG. 2

Fig. 2—The kinematic pitch surfaces of hypoid gears are hyperboloids obtained by rotating the instantaneous axis OP about the axis of each gear

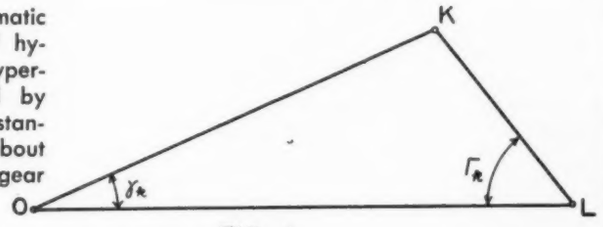


FIG. 4

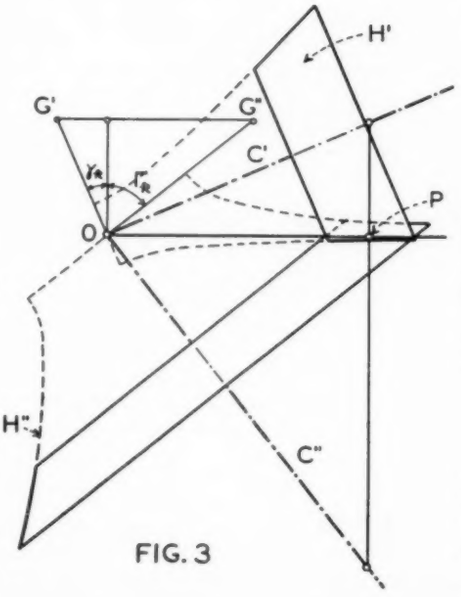


FIG. 3

Fig. 3—The axes C' and C" are parallel to the plane of the drawing in this front view of kinematic pitch surfaces

Fig. 4—The turning velocity about the instantaneous axis and the direction of the instaneous axis OL can be determined by geometrical addition, just as on bevel gears

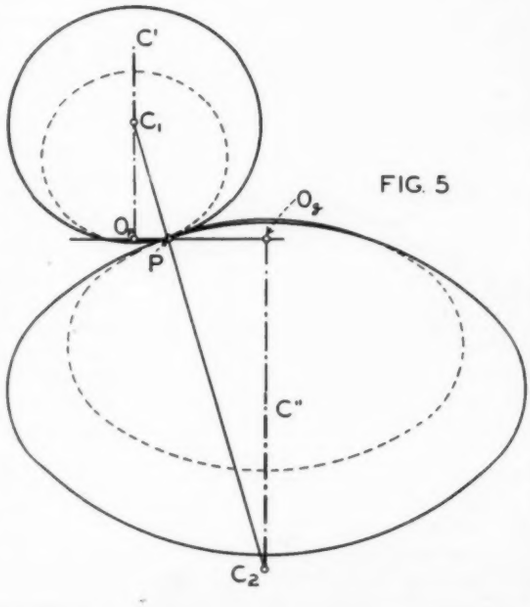


FIG. 5

Fig. 5—A view along the instantaneous axis and a section through point P, perpendicular to it

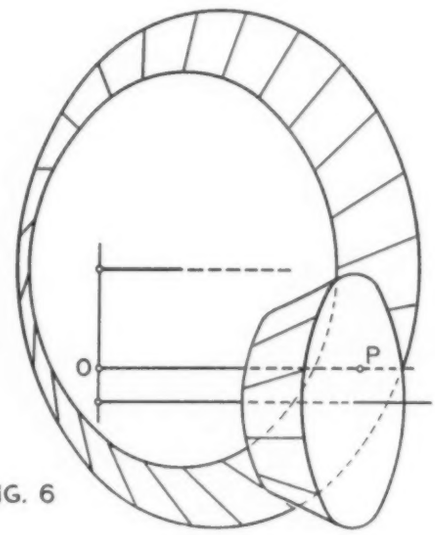


FIG. 6

Fig. 7—Spiral pitch lines can be obtained on hypoid gears by employing different pitch surfaces, which are not here fixed by tooth ratio and shaft angle as are those of bevel gears

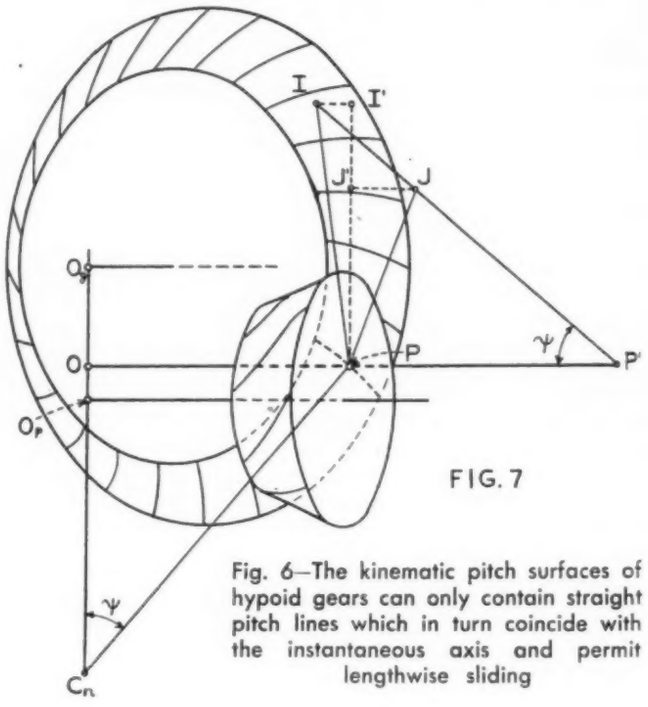


FIG. 7

Fig. 6—The kinematic pitch surfaces of hypoid gears can only contain straight pitch lines which in turn coincide with the instantaneous axis and permit lengthwise sliding

The angular velocity ω_i about the instantaneous axis is as on bevel gears

$$(5)\quad \omega_i = \frac{\omega'}{\sin \Gamma_k} \cdot \sin \Sigma = \frac{\omega''}{\sin \gamma_k} \cdot \sin \Sigma$$

The proportion $\frac{G'G''}{\omega_i}$ of the above two quantities is the translation per radian of turning. The instantaneous lead L_i per full turn is therefore $2\pi \cdot \frac{G'G''}{\omega_i}$, or

$$(6)\quad L_i = 2\pi E \frac{\sin \gamma_k \cdot \sin \Gamma_k}{\sin \Sigma}\ ;\ \pi = 3.1416$$

This important quantity will be again referred to.

(6a) For $\Sigma = 90°$:

$$L_i = 2\pi E \cdot \sin \gamma_k \cos \gamma_k$$
$$= 2\pi E \cdot \sin \Gamma_k \cdot \cos \Gamma_k$$

When rotated about the pinion axis C', the instantaneous axis OP describes a surface of revolution H' known as a hyperboloid. Likewise another hyperboloid H'' is described when the instantaneous axis is rotated about the gear axis C''.

The two hyperboloids touch each other along the whole length of the instantaneous axis. The normal of each hyperboloid at any point of the instantaneous axis is perpendicular to the instantaneous axis, and in this case the conditions for contact are the same as for pure turning about the instantaneous axis. A point of contact is then characterized by its normal passing through the instantaneous axis. All the points of the instantaneous axis fulfill this condition, and are therefore points of contact between these hyperboloids of revolution.

Another proof is apparent from Fig. 5, where the sectional plane intersects the instantaneous axis at point P, and the axes C' and C'' at points C_1 and C_2. The normal to the instantaneous axis and to the hyperboloids is contained in the sectional plane. PC_1 is the normal to hyperboloid H' and PC_2 is the normal to hyperboloid H''.

Contact at P exists when the two normals PC_1 and PC_2 coincide, that is when, in Fig. 5, $\tan PC_1O_p = \tan PC_2O_g$.

With A denoting distance OP, shown in full in Figs. 2 and 3, the projected distances C_1O_p, C_2O_g of Fig. 5 are $A \cdot \tan \gamma_k$ and $A \cdot \tan \Gamma_k$; and projected distances PO_p, PO_g are equal to E_p and E_g. Contact therefore exists when the following equation is fulfilled

$$\frac{E_p}{A \cdot \tan \gamma_k} = \frac{E_g}{A \cdot \tan \Gamma_k}\ ,\ \text{or also}$$

$$\frac{E_p}{\tan \gamma_k} = \frac{E_g}{\tan \Gamma_k}$$

Inasmuch as the distances E_p and E_g have been determined to fulfill this equation, formula (3), contact between the hyperboloids exists at point P, and at all points of the instantaneous axis, at any distance A.

Hyperboloids H' and H'' will be referred to as the kinematic pitch hyperboloids.

Fig. 6 is a view similar to Fig. 2. The equally spaced straight lines drawn on the kinematic pitch hyperboloids in turn coincide with the instantaneous axis, and permit sliding along this axis. They can be used as pitch lines of the teeth. Such teeth contact simultaneously on their whole length at once and, except for the lengthwise sliding, act very much like straight bevel gear teeth which point to the cone center. Originally such straight pitch lines were believed the only ones possible for this type of gears, inasmuch as pitch lines inclined to the instantaneous axis would not permit required lengthwise sliding.

Certain conditions arise when these same hyperboloids H' and H'' are used for a different ratio than originally assumed. If the original ratio was 2:1 and the bodies are turned about their axes C' and C'' at a ratio of say $\frac{N''}{N'} =$ 3:1, then the angular velocities ω', ω'' are in this proportion. In this case sliding at any point of line of contact OP is not lengthwise along this line.

At any point P, Fig. 7, the turning velocity of the pinion, projected into the drawing plane which contains line OP and line O_pO_g, can be plotted as a distance PI—and the projected turning velocity of the gear as a distance PJ.

The turning velocity of the pinion can be resolved into components II' parallel to OP, and PI' perpendicular thereto, both located in the drawing plane of Fig. 7, and into a component perpendicular to the drawing plane.

Turning Velocity of Gear

The turning velocity of the gear, at point P, can be similarly resolved into components JJ' and PJ' in the drawing plane, and into a component perpendicular thereto.

Component PI' is the same as if the pinion axis C' were to pass through point O. It is

$$PI' = A \cdot \omega' \cdot \sin \gamma_k$$

Component II' of the pinion is equal to the lateral motion of point O, when turned about the pinion axis, Fig. 3.

$$II' = E_p \cdot \omega' \cdot \sin \gamma_k$$

On the gear

$$PJ' = A \cdot \omega'' \cdot \sin \Gamma_k; \text{ and } JJ' = E_g \cdot \omega'' \cdot \sin \Gamma_k$$

The relative velocity of the gear pair, at point P, is given by distance IJ, in the projection of Fig. 7. Moreover its direction is the same as the direction of straight line IJ. When extended, this straight line intersects the line of contact OP at a point P', and is inclined to it at an angle ψ.

$$\tan \psi = \frac{I'J'}{II' + JJ'} = \frac{PI' - PJ'}{II' + JJ'} = \frac{A \cdot (\omega' \cdot \sin\gamma_k - \omega'' \cdot \sin \Gamma_k}{E_p \cdot \omega' \cdot \sin \gamma_k + E_g \cdot \omega'' \cdot \sin \Gamma_k} = \frac{A \cdot (\sin \gamma_k - \frac{N'}{N''} \cdot \sin \Gamma_k)}{E_p \cdot \sin \gamma_k + \frac{N'}{N''} \cdot E_g \sin \Gamma_k}$$

$\tan \psi$ is seen to be directly proportional to distance $A = OP$. It is seen then that $\frac{\tan \psi}{A}$ and $\frac{A}{\tan \psi}$ are constant.

$$\frac{A}{\tan \psi} = \frac{E_p \cdot \sin \gamma_k + \frac{N'}{N''} E_g \cdot \sin \Gamma_k}{\sin \gamma_k - \frac{N'}{N''} \cdot \sin \Gamma_k} = B$$

In this formula the angles and linear dimensions refer to the initial gear ratio, and $\frac{N'}{N''}$ is the ratio of the new numbers of teeth of pinion and gear.

The quantity B shows up in Fig. 7 as a distance OC_n on line O_pO_g, where C_n is the intersection point of line O_pO_g with straight line PC_n drawn normal to IP'. The same distance B is obtained at all distances $A = OP$ of point P from O.

Distance PP', Fig. 7, amounts to

$$PP' = \frac{PJ' + JJ' \cdot \tan \psi}{\tan \psi} = \frac{A \cdot \omega'' \cdot \sin \Gamma_k}{\tan \psi} + E_g \cdot \omega'' \cdot \sin \Gamma_k$$

$$PP' = \omega'' \cdot \sin \Gamma_k (B + E_g) =$$

constant. Also

$$PP' = \frac{PI' - II' \cdot \tan \psi}{\tan \psi} = \omega' \cdot \sin \gamma_k \cdot (B - E_p)$$

When a point is moved along the line of contact OP of the two hyperboloids, while they turn on their axes at the new ratio, this point will trace curves on the hyperboloids. The rate of motion of this tracing point determines the inclination of these curves. If the point moves very fast as compared with the rotational speed of the hyperboloids, it will trace curves not much inclined to the line of contact and nearly coinciding with it. And if the point moves slowly, the curves will be more inclined.

Let us consider position P of the tracing point, Fig. 7, where PI represents the projected peripheral motion about axis C', and PJ the corresponding motion about axis C''. If the velocity of the tracing point along line OP corresponds to a distance PP' as above determined, then it moves on the two hyperboloids in the direction of their own relative motion at rates represented by distances IP' and JP'. The curves traced on the two hyperboloids are then tangent to each other at the instantaneous position of the tracing point, that is at point P.

Curves Are Spirals

As distance PP' is constant at all positions of the tracing point along line OP, curves contacting at all instantaneous positions of the tracing point are produced by moving the tracing point at a constant rate along the line of contact. This rate is as determined for position P. The curves thereby traced on the hyperboloids are uniform motion spirals.

Fig. 7 shows equally spaced spirals of this character, which can be considered as pitch lines traced on the hyperboloids. These spiral pitch lines continue to contact at their intersection with the line of contact OP of the hyperboloids when the gears turn. They permit the relative motion of the gears, which include lengthwise sliding of the teeth.

The motion of the tracing point per tooth, that is the pitch p_n of the tracing motion along line OP, is obtained by substituting $\frac{2\pi}{N'}$ for ω', and $\frac{2\pi}{N''}$ for ω'' in the above formulas:

$$p_n = \frac{2\pi}{N'} \cdot \sin \gamma_k \cdot (B - E_p) = \frac{2\pi}{N''} \cdot \sin \Gamma_k \cdot (B + E_g)$$

It is now apparent that spiral pitch lines can be obtained on hypoid gears by changing the pitch surfaces. The kinematic pitch hyperboloids of a different and usually lower ratio can be used as pitch surfaces to obtain spiral pitch lines and an increased pinion diameter.

Broadly, pitch surfaces of a hypoid pair are surfaces of revolution described about the axes of the pair and contacting with each other along a line. Pitch lines are lines of the pitch surfaces which are tangent to each other at their intersection with said line of contact.

Infinite Numbers Possible

With this broad definition infinite numbers of pitch surface pairs are possible for a hypoid gear pair. The pitch surfaces are not confined to hyperboloids. Any surface of revolution may be assumed freely on one member, and called the pitch surface. This surface is generally capable of contacting along a line with a surface of revolution described about the axis of the other member. Their line of contact is always the normal projection of said axis to the assumed pitch surface. And the other pitch surface can be described by rotating the line of contact about said axis. The line of contact thus obtained may be curved.

When a tracing point is moved along it, while the pitch surfaces rotate at the gear ratio prescribed, it will trace lines on the pitch surfaces. The instantaneous rate of travel of the tracing point can be adjusted and varied so that the tracing point moves on the pitch surfaces in the direction of their own relative motion. Mating pitch lines are thereby traced, which contact at the instantaneous position of the tracing point.

While it was believed that too few types of pitch lines were possible on hypoid gears, as compared with the variety of pitch lines possible on bevel gears, it is currently found that there are too many pitch lines and too many pitch surfaces available. This surplus, however, can be narrowed down to cases representing practical solutions.

The second article in this series specifies the unequal pressure angles required for balanced hypoid gear-tooth action and shows how lengthwise tooth curvature depends on the pitch cones used.

TALKING SHOP

1000 Cans for One

According to one Ford engineer, it takes 1000 tin cans to furnish 2.5 lb. of reclaimed tin. It takes that much tin to supply the needs of one automobile in bearings, solder, etc. Maybe first purchasers of the new cars will have to trade in a thousand used cans.

Sardine Train

IF YOU'VE TRAVELED recently, you'll appreciate the story of the sardine family swimming around Massachusetts Bay without much to do. The mother sardine suggested they swim down to Chesapeake Bay to visit her brother's family. "Too long a swim," said Dad. "Let's go down by train." "What," said Mom, "and be squeezed in like people?"

Close Shave

"MOST NOVEL ACCESSORY" for the new *Hudson* automobile is announced as an electric razor that can be attached to the car, for shaving on hunting and fishing trips and for freshening up for a dinner date or late business call. One morning in 1937, we were operating an oscillograph outfit that recorded on film the sound waves from an "enemy" gun picked up by several widely spaced microphones. The oscillograph suddenly went crazy —showing a continuous jitter. We traced the disturbance to the colonel's nearby reconnaissance car (ancestor of the jeep) where he was calmly taking his morning shave, his special 6-volt electric razor plugged in on the dash. Novel accessory, huh?

Veterans' Shops

WE'VE HAD A NUMBER of letters recently from returning servicemen who plan to start job or contract machine shops. Among other things we've suggested are checking the RFC or the WAC for used machine tools and sending 35 cents to the Supt. of Documents, Govt. Printing Office, Washington 25, D. C., for a copy of the U. S. Dept. of Commerce booklet, "Establishing and Operating a Metal Working Shop."

What is a Foreman?

If he is pleasant he is too familiar.
If he is sober-faced, he is a sour puss.
If he is young, he doesn't know anything.
If he is old, he's an old stiff.
If he belongs to a lodge, the members expect favors.
If he goes to church, he's a hypocrite.
If he doesn't, he's a heathen.
If he drinks, he's an old souse.
If he doesn't, he's a tightwad.
If he talks to everybody, he's a gossip.
If he doesn't, he's stuck up.
If he insists that the rules of the shop be kept, he's too particular.
If he doesn't, he's careless.
If he looks around, he's snooping.
If he doesn't he's unobservant.
If he tries to settle all complaints, he must have the wisdom of Solomon.
If he worries about them, he'll soon be crazy.
He should have the patience of Job, the skin of a rhinoceros, the cunning of a fox, the courage of a lion, be blind as a bat, and silent as a sphinx.
What a man!
Are there any good foremen?
Yes, plenty of them, and they're not all in cemeteries.

—*Williams Press News*

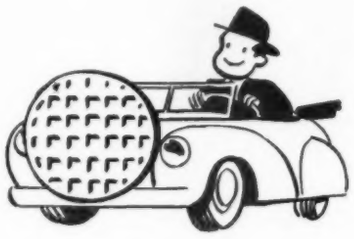
Pilfering Flies

We understand that a prominent manufacturer of optical equipment is now grinding lenses so small that if a fly puts his sticky foot on one he'll carry it off. Every time we tell the story someone asks, "What are the lenses for?" We don't know either.

Railway Doggerel

IN CASE you've never seen it, you may get a smile from this old limerick. We'll tip off the youngsters that "NKP" is railroad lingo for "Nickel Plate."

A machinist on the NKP
Had teeth held in by a FKP
He was embarrassed one day
When his teeth gave way
And dropped from his mouth to the PKP



Waffle Radiator

Instead of the familiar complicated combination of brass tubes and strip which makes up the conventional automobile engine radiator, one producer made during the war a press-fabricated job. Mating steel halves were formed into grids and flash-welded together. Such a radiator, while it had a slightly lower heat-transmission rate than brass, stood up much better in tank service (which soon ruined brass radiators) and expected corrosion troubles did not materialize. We understand a similar design may be used in one of the new cars.

High Measure

A CHROME-COBALT composition, which changes temperature as heat increases, was used by G. E. scientists to determine temperature in a gas turbine after other devices failed.

Dermatitis Preventor

The New Jersey Department of Health says in its latest Industrial Health Bulletin that the best recipe for preventing cutting-oil dermatitis is still personal cleanliness. If the worker washes with a good soap all areas which come in contact with cutting oil before lunch and before he quits work, the danger of dermatitis is cut to a minimum.

THE FAILURE OF "FACT-FINDING"

THE PRESIDENT has asked Congress to grant him authority to appoint fact-finding boards to deal with nationally important labor disputes. Most citizens would like to see some reasonable and objective solution of the industrial strife that now is disrupting reconversion. Unfortunately, the record of the "fact-finding" procedure indicates that any claim of impartiality for this process is a gross misrepresentation.

The Administration bill would authorize the President to appoint such boards in cases certified to him by the Secretary of Labor. Each board would report to the President "its findings of fact and such recommendations concerning the dispute as the board deems appropriate." Its facilities and staff would be provided by the Secretary of Labor. The bill provides for an interval of not more than 30 days known as a waiting or "cooling off" period during which it would be "unlawful" (though no penalties are specified) for anyone to promote or encourage work stoppages.

Because the Administration did not wait for Congressional action upon its proposal, but appointed a number of fact-finding bodies to deal with current emergency cases, we have been afforded at least a partial preview of how the procedure may be expected to work out if laws establishing it are passed.

If the reports handed down by the fact-finding panels in the General Motors and oil disputes may be regarded as representative, it can be stated conclusively that Government-appointed "fact-finding" boards will concern themselves to only a minor degree with the establishing of facts. A far greater share of their effort will be concerned with the speculative business of forecasting future output and production efficiency and appraising the "ability to pay" of the companies involved. But the predominant emphasis will be placed upon framing recommendations for settling the disputes in line with announced Government wage-price policy.

In short, the procedure essentially will be one of registering with the public a government opinion as to how far wages may be raised in the cases at issue without raising price ceilings. Both the General Motors and the Oil Panels stated, in quite explicit terms, that this was their conception of the job assigned them.

"Fact-Finding" in Auto and Oil Disputes

As the General Motors Panel phrased it: "This board subscribes to, and has been guided by, the national wage-price policy" – which it summarizes as calling for wage increases to maintain take-home pay at wartime levels, to the degree possible without inflationary price rises.

The Oil Panel was even more forthright in the statement of what it was supposed to do. "In the judgment of the panel," it declared, "the earnings of the workers must be as high as is consistent with both the maintenance of the stability of the price structure and the provision for reasonable returns to the owners of industry." In other words, prices and the return to investors are to remain fixed, with labor entitled to an ever-increasing return up to the limit of what the traffic will bear.

Having thus outlined their respective conceptions of the job, each panel proceeded to carry out its mission.

The Automobile Panel recommended that General Motors increase its basic hourly wage rates by 19½ cents, which amounts to about a 17½ per cent increase on the company's average hourly wage of $1.12. The Oil Panel recommended an 18 per cent increase in basic hourly wage rates, or an additional 21 cents to the average wage rate of $1.20.

The General Motors recommendation was based almost exclusively upon the Panel's calculation that a 19½ cent raise would keep weekly take-home pay equal to that earned in 1944 when the work-week averaged 45.6 hours. The calculation turned on an estimate of what the effective work-week was likely to be in 1946.

The Oil Panel's recommendation appears to have been based on a more complex but no more conclusive accounting. After calculating that the maintenance of July 1945 take-home pay after 40-hour shifts were restored would require a 22 per cent increase in straight-time hourly wages, it recommended that an 18 per cent increase be made. It accounted for 9½ per cent of this by noting that this was needed to cover cost-of-living rises, and explained that the rest was justified by a combination of factors including loss of premium overtime pay, higher productivity, and settlements already negotiated. Since the Panel gave no indication of the weight given to these several factors, it may not be unfair to assume that the last-named was given preponderant importance, since 18 per cent was the increase already granted in collective bargaining by Sinclair and certain other oil companies.

Higher Pay Without Higher Prices

Both panels stated that the pay increases recommended could be met without raising price ceilings, but neither documents its case on this score with very conclusive "facts".

The Oil Panel confined its observations on this account to the statements that only one company in its group had pleaded "inability to pay" and that the industry was in a generally profitable position during 1943 and 1944.

The Automotive Panel stated that, under a number of assumptions about the 1946 operations of General Motors which it believed to be valid, the Company would have higher earnings than it had in 1941, its previous record year. It specifically stated that its findings in the case were not applicable outside the

automobile industry, but it recognized that the General Motors settlement would more or less determine the settlements of other automotive companies. It stated that it had not been able to arrive at a clear conviction as to the ability of other auto makers to pay similar wage advances, but it dismissed the issue by observing that they could expect to operate at full capacity in 1946, and that this should provide savings to offset the increased wage expenditures.

From the management point of view, one of the most serious limitations in the panels' procedure was their failure to deal with any of the Company claims put forward. In ordinary collective bargaining the demands of both sides are advanced and concessions in one direction are traded for concessions in the other. Here, although the companies involved had insisted upon their need for guarantees against contract violations and wild-cat strikes, and for other union concessions, nothing but the wage issue was considered by the "fact-finding" bodies. The General Motors Panel specifically recommended that the wage increase of 19½ cents be granted, but that otherwise "the status quo prevailing before the strike be restored by the reinstatement of the 1945 contract between the parties." Handled thus, fact-finding becomes indeed a wholly one-sided exercise.

Both panels accepted, quite uncritically, the general position taken by Government spokesmen that wage increases are inflationary only if they are directly translated into price advances. It should be obvious that all wage increases add to the inflationary pressure, if made at a time like the present when consumer purchasing power far outstrips the volume of goods and services available to satisfy it.

"Fact-Finding" Dodged in Steel and Rails

It is ironic, too, that even while the Automotive and Oil Panel groups were holding the "government policy" line, the President and his Reconversion and Stabilization Directors were busily at work trying to dent it. In the steel dispute, although price rises in this industry have a particularly sharp inter-industry impact, hearings by the appointed fact-finding board were deferred while negotiations were carried forward by the President and his advisors under which the industry was offered a price increase of approximately $4.00 a ton on condition that U. S. Steel and the United Steelworkers agree upon a mutually acceptable wage boost. It is hard to avoid the cynical conclusion that wage increases constitute the major administration policy, and that the principle of not translating them into increased prices is sacred only in those cases where there can be some reasonably plausible showing that wages may be raised without price advances.

Much the same general conclusion — that the "facts" are controlling only if they support a substantial wage increase — is sustained by the history of the administration of the Railway Labor Act of 1926, often cited as a glowing example of how "fact-finding" by so-called Emergency Boards of Presidential appointees has served to prevent strikes on the railroads. It is true that reports of almost all of the 31 Emergency Boards appointed to look into threatened railway strikes in the 20 years since the act was passed have provided the basis for a settlement of the disputes in question. The fact — a real fact — remains, that in 1941 and again two years later the wage adjustments found appropriate by Emergency Boards in major railway labor disputes were revised upwards at the White House after the unions involved rejected them as unsatisfactory and threatened to strike. The second upward revision was made after government seizure of the railroads to prevent a national transportation tie-up. When the "facts" did not indicate a large enough wage increase to satisfy the union and the Administration, the "facts" went out the window.

It would be irresponsible to deny the importance of finding some tenable solution of current disputes that threaten to completely disrupt the reconversion process. But upon the evidence of experience, "fact-finding" boards cannot be expected to operate according to the common conception of their function — as agencies designed to sift out for the public an objective and significant weighing of the facts behind conflicting claims.

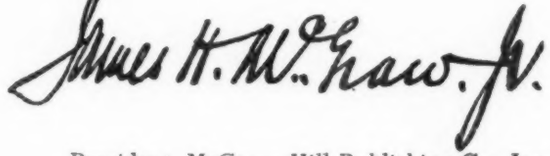
Without Principles Facts Mean Little

Facts, if they are assembled upon a sufficiently partisan basis, can be made to document almost any case one wishes to establish. The major difficulty in marshalling facts to resolve wage disputes is that there are no agreed-upon principles to determine the levels at which wages should be set. In the absence of such principles, it is inevitable that "fact-finding" boards, appointed by the Administration, manned largely by those who helped develop and administer Administration wage policies, and depending for technical assistance upon Administration Departments, will serve merely to implement Administration wage policy.

If Government means to reassert its wartime authority to fix wages — an objective specifically disavowed by the President and seemingly wanted by no one — it should accept the responsibility directly, rather than operate to that end through "fact-finding" boards which are independent in theory, but which cannot be so in fact.

The failure of the brand of "fact-finding" now urged upon Congress by the President is evident. Therefore, we must look for a solution along other lines.

What is needed is for labor and management to agree upon the principles that should govern the determination of wages under free collective bargaining. When such agreement is reached, then and only then, can fact-finding become an objective and useful instrument for settling wage disputes.



President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 44TH OF A SERIES

Devastation to major German cities is typified by this view of Stuttgart. Industrial recovery is hampered as workers search for food and shelter

German Industry Is Taking a Beating

BY WILLIAM J. HARGEST
EUROPEAN EDITOR

• After jeeping for 3,500 miles all over Germany, talking with Allied and German engineers, and studying existing reports, our man-in-Europe estimates that 30% of Germany's industrial capacity has been blasted out of existence. Difficulties in the resumption of industrial operations essential to a minimum economy stem from lack of raw materials, transportation and fuel, as well as unemployment. Living conditions are grim, food inadequate. Here is a realistic appraisal of life for the loser, by an observant engineer who was there.

★ AN AMERICAN MACHINIST REPORT TO THE METALWORKING INDUSTRIES ★

The Krupp Works in Essen, maker of heavy equipment, rolling stock, and munitions, was severely damaged. This plant made large gun barrels and ship propeller shafts. Machine damage has not yet been estimated

THE INDUSTRIAL equipment that survived the devastation of Germany has been found to be surprisingly large, although not as much as some estimates would have it. The most widely circulated estimate of the damage to German industry sets the total at 20% of the nation's capacity, but until bombed areas are completely cleared and minute inspection of plant equipment can be made, a more accurate official estimate will be difficult. However, personal visits to many German industrial centers, information secured from German engineers and from Allied military personnel would indicate that probably as much as 30% of Germany's industrial capacity has been damaged by the war.

One reason for the various low estimates on war damage to the nation is that many initial observers have noted the many machine tools, blast furnaces and open hearths that seemed in good condition, although a closer examination of them often reveals damage that will mean scrapping instead of repairing. Thus, untouched or little-damaged blast furnaces or open-hearths, long idle and full of dampness, will have to be torn down and rebuilt. Similar situations apply to practically all other types of industrial facilities.

In any event, removal of plant equipment for reparations, and destruction of specialized war production facilities, will increase the reduction of Germany's industrial potential by another 5 or 10%. This means that the industrial capacity that will eventually be left to Germany may be from 60-65% of prewar totals.

Particular sections of the country were more heavily damaged than others. The Ruhr valley was one of these. But despite the immense structural damage there, particularly to some plants subjected to concentrated bombings, it is believed that production could recover to 50% of prewar within a reasonable time.

Careful observation and informed opinion indicates that industry in the British, American, and French zones could achieve 60-70% of prewar production with minor plant and equipment repairs. Of course, such production levels will not be reached, because of United Nations' control of industry, lack of raw materials and manpower, and seizure of equipment as reparations.

Berlin faces a staggering problem, chiefly because of the large-scale removal of equipment by the Russians before troops from the west moved in. Machinery was removed wholesale from factories, and sometimes complete factories were dismantled and shipped to Russia. In the British zone of occupation of Berlin, about 90% of machinery, equipment, and raw materials was removed by the Russians. Accordingly, it is believed that it would be easier to restore 50% of prewar production to the entire British and American sectors of Germany, than to restore 5% to the Berlin area with so much equipment missing.

In Spandau, one of the largest Berlin factory areas, it is estimated that 120,000 people were engaged in the production of industrial and war equipment during the last months of the war. Today, only 5,000 are working and most of these are clearing rubble. The Siemens factories, which employed 50,000 people in peacetime to make about 80% of German electrical equipment, are only employing 250 to make rakes, wheelbarrows, and wooden buckets. A similar situation prevails at the large A.E.G. and Telefunken factories. Osrams, producer of electric light bulbs, has been stripped of its equipment.

Despite such conditions, occupation authorities are making small beginnings toward rehabilitation, using the little equipment that remains. Arrangements are being made for the production of priority goods, such as

medical equipment, food-processing units, footwear, stoves, cooking utensils, soap and clothing. This may permit production in this area of Berlin to reach about 25% of its prewar level, but it is doubtful that it will go as high as the 50% earlier estimated, unless a complete re-equipment program is instituted.

Of course, the problem of German industry is tied to the inflexible policy of making the nation powerless to wage another war. This necessitates the present rigid control over production of capital or civil goods, which is permitted on the basis of the most urgent needs and demands of the occupying forces. To exemplify types of production permitted, Table I lists factories in partial operation today.

Certain other products are on restricted lists, and plants that made them are being dismantled and equipment confiscated as reparations. These plants are listed in Table II. On December 11, the first allocation of German plants and industrial equipment to meet reparations was agreed upon by the Allied Control Council. The list comprised 30 of the plants listed in Table II, situated in the three Western zones (American, British and French). Allocations apply only to movable industrial equipment.

Seven plants have been allotted to Russia and Poland. One, the Kugelfischer Georg Schafer ball-bearing works at Schweinfurt, is divided equally between Russia, Poland and the Western Allies. The remaining 22 plants are to go to the Western Allies.

The Krupp plant at Borbeck was allocated to Russia and Poland, as were the Deschemag-Wesser shipyards at Bremen. The Blohm-Voss shipyards at Hamburg are assigned to the Western Allies and not to Russia, as had been expected. The Western Allies participating in these reparations include: the United States, Great Britain, France, Holland, Luxembourg, Yugoslavia, Czechoslovakia, Greece, Egypt, South Africa, Australia, New Zealand, Canada, India, Denmark and Norway.

On January 5, 1946, a further list of plants available for reparations was announced, as in Table III.

FACTORIES AT WORK

The Germans have a very difficult time understanding democratic free enterprise because they are so used to rigid government centralization and control of all phases of business. Thus, when occupation authorities tell

GERMANY PREWAR

Germany's prewar economic development chiefly stemmed from first-rate technical research, heavy industrial production backed by her rich coal deposits, and a fine waterway system and well-planned railway network. Her resources of natural or synthetic petroleum were very limited, and her mineral desposits deficient in many respects.

In 1939, 42% (28,000,000) of her working population was employed in industry, while over 25% (19,999,999) was engaged in agriculture and forestry. She imported most industrial raw materials, as well as many food and agricultural products, and paid for these through exports of the products of her iron and steel, chemical and machinery industries. Her population was thus able to enjoy one of the highest standards of living in Europe.

The iron and steel industry centered around the coal deposits of the Ruhr, the Saar and Upper Silesia. Production in 1939 totaled 21,700,000 long tons of pig iron and 26,444,000 tons of steel ingots and castings. High-grade ore was imported largely from Sweden, with small additions from the Lorraine-Luxembourg deposits.

Much of this capacity was in a 400-sq. mi. area in the valleys of the Ruhr and the Rhine, stretching from Duisburg to Dortmund. It supported a population of 13,500,000. The area boasted one of the world's most efficient gas and electric grids. Its transportation system was second to none. Outside of this area, most of the remaining iron and steel capacity (excepting the Saar basin) was concentrated in a few large plants, such as the Hermann Goering Works at Salzgitter, the Ilsederhutte at Peine, and the Mitteldeutsche Stahlwerke in Saxony.

Germany's efficient railway system, the Reichbahn, before the war had 35,000 miles of roadbed, 21,300 steam locomotives, 500 electric locomotives, 700 main-line diesels, 1,200 shunting diesels, 73,000 passenger cars, 22,000 baggage cars, and 617,000 freight cars. Yet, nearly 20% of the nation's prewar traffic was carried via 8,500 mi. of inland waterways which link her rivers with North Sea and Baltic ports.

In her Reichautobahn, Germany had the most extensive network of speed motor roads in the world. Originally, 6,500 mi. of dual-traffic highways had been planned, but only 2,500 mi. had been completed by 1939, with another 750 mi. added during the war. This network connects Berlin with major German cities along the nation's borders. Economic conditions (and probably military plans) affecting traffic density determined the general location of the routes.

Coal provided the key to Germany's economy, and accounted for 34% of rail freight and 33% of water freight. In 1938, output of hard coal exceeded 186 million tons, while brown coal production was just under 195 million tons. About 500,000 miners worked the pits. Of the 115 coke plants in the nation, 82 were concentrated in the Ruhr. Besides supplying the requirements of the metallurgical and synthetic industries, coke provided surplus gas for industrial and domestic heating.

These basic industries supplied materials for the manufacture of consumer and capital goods, giving Germany a high position among industrial nations with regard to quantity and quality of production. Most of her exports were handled through the main ports of Hamburg, Emden and Bremen. Hamburg was the third largest shipping center in the world, and in 1938 it handled 18,000,000 tons of imports and 7,250,000 tons of exports. Its main industries included railway rolling stock, motor cars, tires, sewing machines, bicycles and other products.

Other highly industrial centers included Berlin, Dresden, Leipzig, Hanover, Kassel, Frankfurt, Stuttgart, as well as the Ruhr, Saar and Rhine valleys.

them to go back to competitive and non-regimented business, they do not know how to go about it. They are offered permission to become members and to participate in chambers of commerce and trade unions, but they have difficulty realizing that this is not compulsory.

According to the 1944 records of the Reichsgruppe Industrie, there were 14,280 industrial plants employing ten or more persons in what is now the U. S. zone. On December 1, 1945, 2,264 factories in the zone were authorized to resume operations, representing 15.5% of the Reichsgruppe Industrie total. Of the 2,264 resuming plants, 1,269 are sawmills, utilities installations, and railway and automotive repair shops. The others include 145 plants producing machinery and other factory equipment, with the remainder producing consumer goods chiefly. However, there is some limited production of farm machinery, ball bearings, bicycles and motorcycles.

Even though these plants have been utilizing existing stocks of raw materials and semi-processed parts, they were operating at 5% of prewar levels on December 1. Since then lack of fuel and essential raw materials has reduced the operating rate of some plants even below that figure, and several factories have had to close down.

All industry is feeling the Nazi purge. Thousands of former Nazis in supervisory or managerial capacities have been thrown out with no consideration for any resulting inefficiency.

MACHINE TOOLS

Germany began the war with the belief that her production of machine tools was adequate to meet all eventualities. (*Ed. Note*—The Foreign Economic Administration estimated that in December, 1939, Germany had 1,400,000 machine tools, but this included non-tool items such as hammers, riveting machines, bending and straightening machines, presses, shears, sheet-metalworking machines, and wire-working and treating machines. The nearest comparable data on similar equipment in the United States is the *American Machinist* 1940 Inventory of Metalworking Equipment, indicating we had a total of 1,323,131 of similar units. Allowing for minor differences in the categories of units covered in both summary totals, it is obvious that the Germans had about as many machine tools as the United States did when the war started. (In fact, in relation to its population Germany had twice as many machine tools as the U. S. did per capita.)

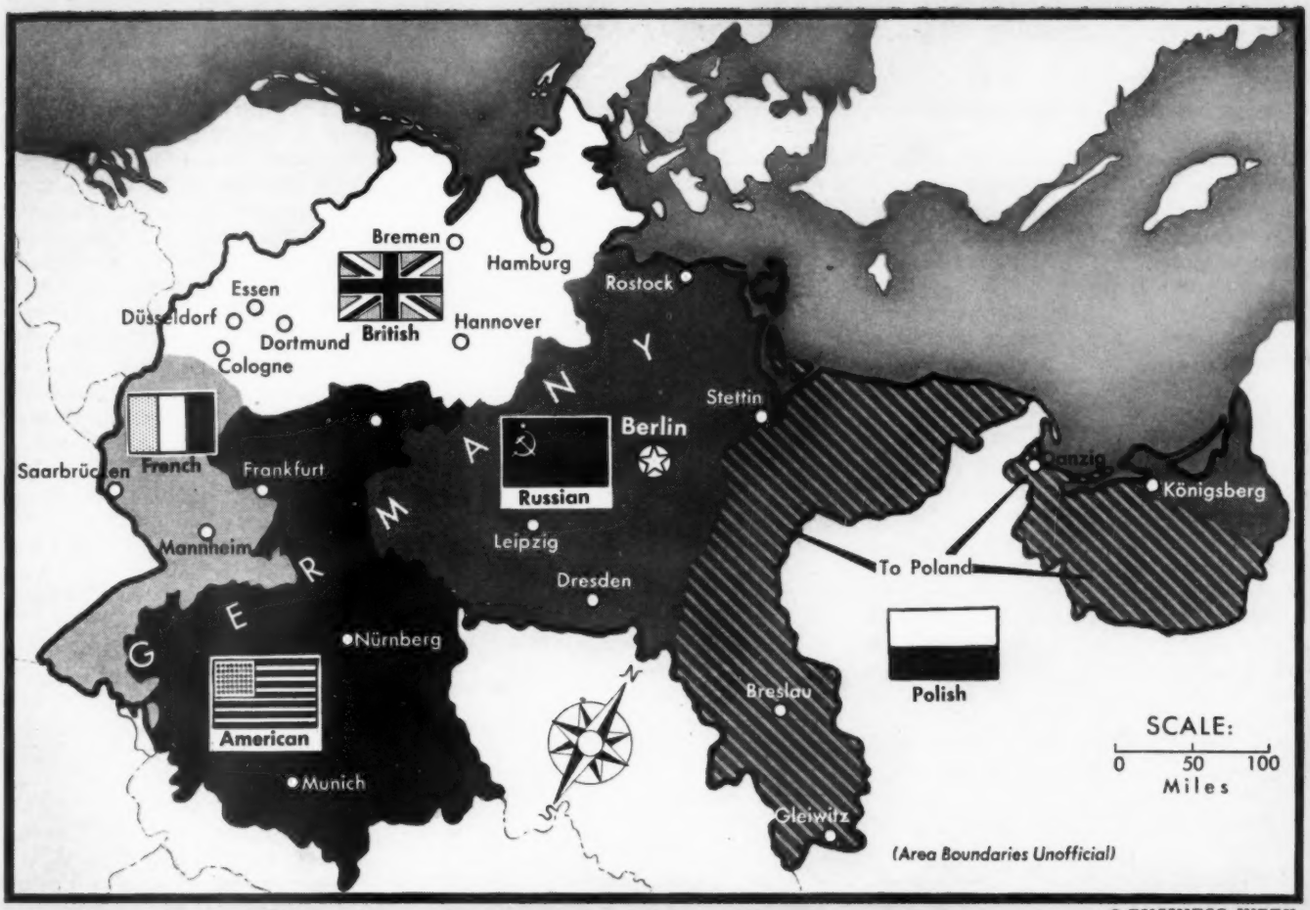
Moreover, her factories had more new machine tools in proportion to its population, and in proportion to its size and plants, than either Britain or the United States. (*Ed. Note*—At the end of 1939, only 30% of U. S. machines were less than 10 years old, while over 65% of German equipment was less than 10 years old at that time.) German engineers say this was a result of the Nazi Government's policy regarding taxation and depreciation schedules. To encourage modernization of German industrial equipment, the regular depreciation rate allowed was 25%; in 1933-34 special allowances up to 100% of the value of newly purchased units were made. (*Ed. Note*—The U. S. machine-tool depreciation rate averages 5% annually.)

It has been estimated that around 4,000,000 tons of machine tools, or 85% of Germany's war peak (*Ed. Note*—FEA estimates German machine-tool holdings at the 1943 year-end at 4,200,000 tons or 1,900,000 tools), are still intact or can be made operative with only minor repairs. Also, there is a vast undamaged capacity for new machine-tool production. Of 20 machine-tool factories visited by this correspondent in Frankfurt, Darmstadt, Offenbach, Stuttgart, Esslingen, Brunswick, Hanover and Berlin, actual total damage to production facilities is estimated to be not more than 10%. One of the most badly damaged was the Naxos-Union plant in Frankfurt. Its facilities for production of grinding wheels were so heavily bombed as to be absolutely useless, but its machine shop which produced precision grinding machines was undamaged even though it was 50 yards away.

Although the over-all figure of damage to German industrial capacity is not conclusive, the estimated damage to the machine-tool industry

TABLE I—FACTORIES IN PARTIAL PRODUCTION

PRODUCT	NAME OF FACTORY	LOCATION
Agricultural machinery	Karl Schenk	Darmstadt
Benzine and ammonia	Leuna	Dresden
Buckets	Siemens	Berlin
Chemicals	Rohm & Haas	Darmstadt
Conveying machinery	Bahnbedarfs Rodberg	Darmstadt
Cooking utensils	Roeder	Darmstadt
Diesel motors	Demag	Darmstadt
Farm machinery	Steyr Motors	Essen
Kitchen stoves	Roeder	Darmstadt
Trucks	Steyr Motors	Essen
Trucks	Krupp	Essen
Metal roofing tile	Ferdinand Goeb	Frankfurt
Motor car parts	Julius Pintsch	Berlin
Motor cars	Siemens-Schuckert	Bad Neustadt
Motor cars	Opel	Darmstadt
Motor cars	People's Car Works	Fallersleben
Motor fuel	Leuna	Merseburg
Motor fuel	Bredag	Zeitz
Motor fuel	Brabark	Rusland
Perspex glass	Rohm & Haas	Darmstadt
Pharmaceutical	E. Merck	Darmstadt
Platform trucks	Bahnbedarfs Rodberg	Darmstadt
Porcelain	Nymphenburg	Munich
Radio repairs	Phillips	Berlin
Roofing	Aggemann	Hermsdorf
Rubber goods	Demag	Darmstadt
Steel construction	Donges	Darmstadt
Stoves	Siemens	Berlin
Telephone equipment	Telefunken	Berlin
Ticket printing machines	Goebel	Darmstadt
Tractors	Steyr Motors	Essen
Typewriters	Olympia	Erfurt



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POTSDAM MAP OF GERMANY

The Potsdam agreement slated Germany for occupation in this general order, with the British in the north, the Russians in the east, the Americans in the south, and the French in the west. Poland was ceded eastern German areas to offset losses to Russia

is quite correct. The reason is the decentralization of German industries, so that even when one factory was bombed, other plants continued to make the same product. Few German plants turned out the entire production of one item. Decentralization was accomplished by a system of small plants, often utilizing individual machines in garages and private homes. In addition, there were underground plants, duplicate standby plants, and special protected plants.

There is no doubt that the German machine-tool industry will be rigidly controlled. (*Ed. Note*—FEA Technical Industrial Disarmament Committee recommended that German machine-tool output be reduced from the wartime annual output peak of 700,000 metric tons down to 25,000 tons, and that total German machine-tool holdings be reduced to 500,000 tons from the current total of around 4,000,000 tons.) Such action would eliminate Germany as a machine-tool competitor in world markets. The benefit of this step to British and American tool producers is indicated by the fact that at the outbreak of war machine-tool production in the United States, Britain, and Germany was in the ratio of 4:3:2.

Germany's present machine-tool inventory will be used: (a) for reconverting its industry to civilian goods production, and to provide equipment for the occupying armies; (b) for payment as reparations; (c) and machine tools designed for war production will either be scrapped or sent to Allied nations for study and use. When the current inventory of undamaged machine tools has been completed, German factories needing additional tools will require a license from the military government. Other proposals under study include the prohibition of imports and exports of such equipment, and the enforced scrapping of an equivalent old tool as new ones are built for domestic use.

Few radical developments in machine tools were made during the war years. However, German engineers report that, before 1940, their tool builders made special machines for war production, incorporating special tooling in standard machines. All these are now being made available to machine-tool builders in Allied countries, as are standard types with or without special tooling. Those machines designed specifically for war production will no doubt go to Allied arsenals. In some instances, technical representatives from Allied countries are being sent to Germany to select desired equipment.

In Britain, trade associations have been requested by the Board of Trade to compile schedules of German equipment that their members would like to obtain under the reparations scheme.

TABLE II—FACTORIES DISMANTLED FOR REPARATIONS

PRODUCT	NAME OF FACTORY	LOCATION
Aero engines	Daimler-Benz underground factory	Obrighein
Air compressors (large)	Brown Boveri	Eberback
Aircraft engines	Bayeriache Motorwerke No. 1	Munich
Aircraft engines	Bayeriache Motorwerke No. 2	Munich
Airplane parts	Nazi underground factory	Neckarelz
Ball bearings	Kugelfischer Georg Schafer	Schweinfurt
Diesel engines	Klockner Lumboldt Dietz	Oberursal
Electric power	Gross-Draftwerke-Mannheim	Mannheim
Electric power	Gendorf power station	East of Munich
Electric power	Hastedt power station	Bremen
Electric power	Toging power station	Toging
Explosives	Fabrik Hess Lichtenau	Nr. Furstenhagen
Heavy machinery	Krupp	Essen
Instruments	Hensoldt	Herborn
Truck engine parts	Nazi underground factory	Neckarels
Machine tools	Hahn-Tessky Indexwerke	Esslingen
Machine tools	Fritz Muller	Oberesslingen
Machine tools	Bohner Koehle	Esslingen
Machine tools	Hahn Kolb	Stuttgart
Metallurgical	Krupp	Borbeck
Munitions	I. G. Farben plants	
Munitions	(Fabrik Kaufbeuren)*	Kaufbeuren
Munitions	(Fabrik Ebenhausen)*	Ingolstadt
Munitions	(Fabrik Aschau)*	Meuhldorf
Optical	Hensoldt	Herborn
Ordnance	Krupp	Essen
Pig-iron	Norddeutsche Hutte Aktiengesellschaft	Bremen
Shipyard	Deschemag-Wesser	Bremen
Shipyard	Blohm-Voss	Hamburg
Steel ingots	Norddeutsche Hutte Aktiengesellschaft	Bremen
Torpedoes	C. F. Bergeward motor car plant	Bremen
U-Boats	Deutsche-Schiff und Maschinenbau	Bremen

*These plants destroyed; however, much of their equipment has been set aside for reparations.

TABLE III—OTHER FACTORIES OFFERED FOR REPARATIONS

PRODUCT	NAME OF FACTORY	LOCATION
Aircraft Parts	Norddeutsche Dernierwerke No. 2	Leubeck
Beds & Utensils	Norddeutsche Dernierwerke No. 4	Rothebeck
Munitions	Rinker	Minden
Munitions	Metallwerke Wolfenbuettel GMBH	Wolfenbuettel
Furniture	Stuhlrehr von Rudolf Sieverts	Hamburg-Bergedorf
	Norddeutsche Dernierwerke No. 7	Sierkgrade
Smokeless Powder	Fabrik Kaufbeuren	Kaufbeuren
Smokeless Powder	Fabrik Ebenhausen	Ingolstadt
Nitrocellulose	Fabrik Aschau	Muehldorf
Ordnance	Wehrmacht Ordnance Plant	Strass
Ammunition Loading	Geretsried-Wolfratshausen	Wolfratshausen
Ordnance	Wehrmacht Ordnance Plant	Desnig
Aluminum Foil	Werke Scheldin	Tenningen
Farm Equipment	Maschinenfabrik Fahr A. G	Gottmadingen
Tractors	Maschinenfabrik Gebruder Kramer	Gottmadingen
Rifles & Pistols	Mauser Co.	Oberndorf
Vitryl Chloride	I. G. Farben A. G.	Rheinfelden
Peroxide	Regussa Co.	Rheinfelden
Ignition Equip.	R. Bosch	Sule
Screw Machine Prod	Suddeutsche Arguswerke	Baden-Baden
Machinery	Hamwell-Lug	Duesseldorf
Fireproofing	Bendorf-on-Rhine	Bendorf
Soda	Mathes & Weber's	Duisburg
Machine Tools	Wagner	Dortmund
Power Plant	Togency Hydro-Electric	Muhldorf
Small Arms	Metallwerke Nuerngamme	Hamburg
Cartridge Cases	Hanseatische Kettenwerke	Hamburg

INTERZONAL TRADE

In accordance with the Potsdam agreement, which states that Germany shall be treated as an integral economic unit, the Allied policy on interzonal trade is to permit as free and unrestricted trade as possible. The list of critical items controlled by rationing or allocation, which may be transferred between the four zones of occupation, only with approval from the Military Government, includes coal, lumber, glass, petroleum, oil and lubricants, soap products, pulp and paper, highway vehicles, locomotives and rolling stock, road-construction machinery, textiles, leather, and rationed clothes, shoes and foods.

Retarding influences on the resumption of interzonal trade are such handicaps as inadequate telephone and postal communications, transportation facilities, and travel restrictions on German civilians for security reasons. But such conditions are being improved as rapidly as possible. Postal service has almost been fully reconstituted within the zones but not between them as yet.

Interzonal trade is important in the limited resumption of German industry. For example, resumed operations of a Bavarian sawmill requires wood-cutting tools from the Ruhr, and some saw-mill products, such as pit props, are required in Ruhr valley coal mines.

FOREIGN TRADE PROSPECT

With only a small amount of foreign trade needed, outside of occupational requirements, Germany is largely sealed off commercially from the rest of the world. German governmental agencies, private firms, and individuals are strictly prohibited from engaging in foreign trade activities without permission of occupation authorities. Under the provisions of Allied policy and the Potsdam Agreement, imports into Germany are limited to military supplies and to those civilian supplies without which occupational aims would be endangered by resulting diseases and disorder.

Exports are limited to those necessary to pay for the imports, to military supplies for Allied forces, and those commodities required by liberated countries, the lack of which would affect such military operations as the redeployment of troops and the occupation of Germany, or which endangers the minimum basic economy of the liberated countries.

German importers do not seem to comprehend the intentions of the United Nations, and many are already thinking of postwar business, believing that only lack of communications and transportation is holding up trade negotiations. For example, a Berlin importer wrote to an American firm offering to handle the sale and distribution of construction machinery so badly needed for the rehabilitation of bombed areas. He has offered to move his business from Berlin to Hanover to prevent confiscation of imported equipment by the Russians.

GERMANY'S IMMEDIATE PROBLEMS

The immediate problems, even when viewed in the light of the Potsdam Agreement calling for a minimum economy in Germany, deal with food, fuel, electrical power, water supply, housing, production of essential commodities, transportation and communications. All these have received much attention by the Allied authorities during the past six months.

The lack of food, fuel and shelter are adversely affecting the industrial scene. Search for these essentials is increasing factory absenteeism. Disease and malnutrition are decreasing by the thousands the numbers of skilled and competent workmen who would normally be at work in the factories, fields, or engaged in clearing rubble and repairing or building homes.

Lack of locomotives and freight cars has prevented proper distribution of food, building materials, and fuel, particularly coal. For lack of coal, the few steel plants permitted to operate, as well as gas producers and power plants, cannot function properly. Lack of steel prevents repair of railway motive power and rolling stock. Through November and December, there was a declining and dwindling spiral of production of essential products from these causes.

Industrial plants listed in Table I exemplify the type that are today making quantities of essential consumer goods to maintain a minimum civilian economy. Others, using wartime inventories, are producing equipment for Allied occupation forces. Factories are authorized to buy captured German military equipment and material when such purchases implement production and distribution of essential commodities. These goods fall into three categories: (1) Transport vehicles, spare tires, shop equipment, tools, fuels, lubricants, highway maintenance materials and equipment, tractors and horses; (2) Items for production of urgent civilian needs, such as food, shelter, fuel, medical and sanitation supplies, work shoes, and clothing; (3) Office equipment and supplies, radios, kitchen and tableware, if they are surplus.

In the first four months following VE-day, while factories were being surveyed and a start made on production, remarkable progress was made in reconstruction of motor roads, inland waterways, railways and communications, considering labor and material shortages, and the slow repairs to locomotives and freight cars.

Two-thirds of the major bridges in Germany were heavily damaged, mostly by Nazi demolition squads. The proportion of railway bridges was even higher. Before Nov. 1, U. S. army engineers had repaired 10,000 miles of track or 90% of the total in their zone. By the same date, British engineers with civilian help rebuilt or repaired 58 bridges, laid 7,200 mi. of new track, and had all major rail lines in operation in their zone. An indication of the work accomplished in rebuilding right-of-way is given by the increase in tonnage hauled since VE-day, from negligible tonnage in June to 20,000 tons daily in July and over 130,000 tons a day in November.

Despite the restored right-of-way, transportation is still greatly limited by the lack of motive power and rolling stock. Figures on railway equipment are given in Table IV. On November 1, 1096 shops in the American zone, employing 8,600 men, were repairing locomotives and cars. These are operating from 5-75% of capacity as a result of removal of equipment before advancing armies, and damage through Nazi demolitions and air raids. In the British zone, repair

This is what is left of the bomb-damaged Thyssen steel rolling mill in Duisburg, part of the largest steel plant in Europe. The works employed 12,000 men and turned out 230,000 tons monthly at peak levels

shops are working at similar capacity. Three of the largest shops in Germany are in this zone—one at Hamburg is repairing 1,000 gondolas and hopper cars a month on an assembly-line basis. This equipment is primarily intended for coal transportation equipment.

Restoration of German telephone service made substantial progress up to December 1. Despite inadequate qualified personnel and scarcity of transportation and supply, 744 central offices, employing 43,000, are in operation in the American zone—344 dial and 400 manual. These offices serve 36,000 civilians in essential jobs and all military calls emanating from 7,000 phones. In January, 1939, there were 1,621 central offices in the same area, employing 79,000.

Reconstruction of inland waterways has also been phenomenal. Locks have been repaired, debris and damaged bridges have been removed, and sunken barges and tugs have been hauled ashore or refloated. The Rhine river in the American zone was opened to limited navigation by September 1, and was cleared 45 days later. The lower Rhine was cleared by the British at about the same time.

Dutch, French and Belgian vessels on the Rhine total about 1,000,000 tons, while German tonnage is estimated at nearly 500,000, a total capable of moving 14,000 tons of bulk cargo daily. There also is a tank barge fleet of 12,000 tons capable of moving an estimated 500 tons a day. The Main River was opened for barge traffic to Frankfurt on September 1, and to Wurzburg on October 1. The Neckar River was cleared early in November.

Practically all river ports in the British and American zones are open, and those under American control—including Aschaffenburg, Mannheim, Karlsruhe, Frankfurt, and Hanau—can handle 30,000 tons of cargo a day other than bulk wheat.

REVIVING HIGHWAY TRANSPORTATION

After the occupation, all German motor cars and trucks were confiscated and pooled for distribution to Allied personnel and essential civilians. As German civilian administrations increased in reliability, these motor vehicles were gradually returned to private ownership, mainly small-fleet operators, doctors, and civilian personnel employed by Allied agencies.

Early last summer, the Military Governments pushed reconstruction of the German motor-car industry, and instituted plans to begin partial production in the People's Car Works, and the Siemens-Schuckert and Opel factories. By November, orders had been placed for some 50,000 cars, of which about 10,000 were to be ready in January, 1946. These cars will go to Allied Control Council and military government officials, as well as to civilians on essential jobs. Trucks are in production at the Krupp Works and Steyr plant in Essen.

The truck situation has been so bad that in November and December, British and American army vehicles were assigned to civilian agencies, particularly those transporting food and repairing houses in the most heavily bombed areas.

In the British zone, army engineers organized the operation of civilian motor transport, as well as repairs to privately owned vehicles. Repair crews travel the highways. A series of garages and large workshops were set up in September, utilizing the best of available plant and labor. There are 1,100 of these, including 14 where complete overhauls can be made, and 16 where extensive repairs are possible. The 30 heavy-repair shops have overhauled 5,000 trucks and cars to date. The garages have undertaken 200,000 repairs. Work is done by 60,000 Germans under the direction of army engineers.

Despite such efforts, German motor transport remains pitiful compared to its prewar status, and is one of the major factors now contributing to hardships and privation from lack of food, fuel and shelter.

THE COAL PROBLEM

The Ruhr normally accounts for over two-thirds of Germany's annual hard-coal production of 185,000,000 tons and for over 80% of total coking coal, as well as large quantities of brown coal.

In August, the annual production of the Ruhr coal mines had been reduced to 30,000,000 tons as a result of damage to collieries through flooding and air raids, as well as the

TABLE IV—DATA ON GERMAN RAILWAY EQUIPMENT AS OF DECEMBER 1, 1945

Zones	Locomotives (A)		Passenger cars		Baggage cars		Freight cars	
	Operating	Unserviceable (B)	Operating	Unserviceable (B)	Operating	Unserviceable (B)	Operating	Unserviceable (B)
British	6,540	3,530	9,200	11,980	2,800	3,600	116,000	64,000
American	2,700*	3,230	8,000	11,000	2,200	3,600	116,000	47,000
Russian & French	3,200	2,800	9,000	11,500	2,500	3,000	100,000†	50,000
TOTAL	12,440	9,560	26,200	34,480	7,500	10,200	332,000	161,000
Destroyed or Damaged beyond Repair		1,750		22,320		4,300		124,000
GRAND TOTAL	12,440	11,310	26,200	56,800	7,500	14,500	332,000	285,000

(A) Steam—21,278; electric—572; main-line diesel—700; shunting diesel—1,200. (B) Unserviceable, but reparable. * Includes 143 U. S. Army locomotives. ♯ Estimated by former Reichbahn engineer. †Includes 34,910 box cars; 659 refrigerator cars; 63,716 gondolas; 6,687 flat cars; 7,123 tank cars; and 2,755 miscellaneous

shortage of labor. A further contributing factor was the shortage of lubricants, pit posts, explosives, miners' clothing and other supplies. In any event, at that time 166,000 miners were working the pits, or 240,000 fewer than normal. The immediate target of the Coal Control is to increase employment to 275,000, primarily to meet a commitment of 25,000,000 tons promised to the Western European Allies during the six months ending April 30, 1946, as well as to supply minimum German requirements.

There is little likelihood of fulfilling this promise, because present monthly production in the Ruhr is 4,600,000 tons, and about 972,000 tons were exported to liberated zones in December. However, about 40% of the total is required in Germany to maintain German utilities. Other major users include the railroads and the requirements of the occupation forces. The smallest current consumer of coal in Germany is its industry.

Further production increases will be difficult due to lack of supplies, inadequate labor, and poor living conditions. Many Ruhr miners are staying out of the pits to repair their homes and seek food.

With Allied airmen making railroad equipment their special target, the damage to German transportation facilities was enormous. These used to be passenger cars before they were caught in a raid on Hanover

HOUSING SITUATION

The destruction that Germany has brought upon herself will impose severe limitations upon industrial output for many years to come. Aside from the rehabilitation of factories and plant equipment—within the restrictions set by the United Nations—there is the even greater job of rebuilding cities, which is no mean task. German engineers maintain it will take from 20 to 40 years.

The devastation in every large city almost defies description. Shelter is afforded by bombed buildings or temporary structures made from rubble. Estimated destruction ranges from 70% of the Ruhr cities to 65% of the North Sea ports of Hamburg, Emden and Bremen. Major inland industrial centers such as Dresden, Leipzig, Kassel, Frankfurt, Hanover, Brunswick, Darmstadt, Karlsruhe, Mannheim, and Stuttgart suffered an estimated 50-60% destruction. These estimates include buildings or portions of buildings slated for razing.

An idea of the task ahead is indicated in the official statement that if 1,000 tons of rubble were removed every day of the year from Essen, it would take 30 years to clear the city completely. In Berlin, 65,000 tons of bombs and 40,000 tons of shells and mines reduced the center of the city to a sprawling wilderness, and shattered the surrounding districts. The relative extent of destruction in Berlin is revealed by these official figures from the British sector:

Total houses in British sector	25,278
Completely destroyed	4,207
Damaged beyond repair	3,656
Heavily damaged but reparable	2,286
Slightly damaged	6,068
Total number affected	16,217
Undamaged houses	9,061

Repairs to 228 heavily damaged and 1,644 slightly damaged houses were completed by the British in Berlin by December 1. On that date, 193 heavily damaged and 985 slightly damaged houses were still undergoing repairs.

THE JOB AHEAD

The Germans do not seem greatly dismayed by war's ruination, now that it has finally reached them. It is apparent that they will put a sullen and defiant enthusiasm into reconstruction. They appreciate the United Nations' intention of rigorously controlling industry to prevent reoccurrence of 1920-38 events. But they can neither comprehend nor understand any policy that will not permit industrial development with the highest possible living standard as its objective. In fact, many of them view current re-industrialization efforts of the Allied governments as the first step toward an industrial Germany that will keep the standard of living at its prewar level. And this is in spite of the Potsdam Agreement stipulating a future standard no better than the European average. The Germans on their own initiative will strive to better this, looking for loopholes in Allied agreements, just as they sought loopholes in the Versailles Treaty during the 1920's.

Engineers and technicians visiting Germany have expressed the opinion that it is essential to the material welfare of all Europe and to the reparations claims to allow Germany to rebuild her industrial productive power during the immediate postwar years, subject to complete supervision on strategic grounds. If controlled properly, German industry can raise the over-all continental standard of living rather than—as proposed—lower the German standard to that of other European nations.

Constant Delivery of Clean Oils Boosts Output and Saves Equipment

BY PHILIP C. BOOTY, WORKS MANAGER, WEST PULLMAN WORKS, INTERNATIONAL HARVESTER CO.

WHERE the number of processing units and production requirements are great enough, a centralized oil reclamation and distribution system is both economical and efficient. At the ball-bearing plant of International Harvester Company, all cutting, quenching and cleaning oil and soluble-oil coolant are handled in this manner. As a result, downtime has been decreased, maintenance costs lowered and continuous delivery of clean fluid at constant pressure guaranteed.

Coordinated with production-line layout, this system reclaims and supplies:

Cutting Oil: to automatic screw and chucking machines

Quenching Oil: to oil tanks in three heat-treating lines

Cleaning Oil: to bearing-washing equipment

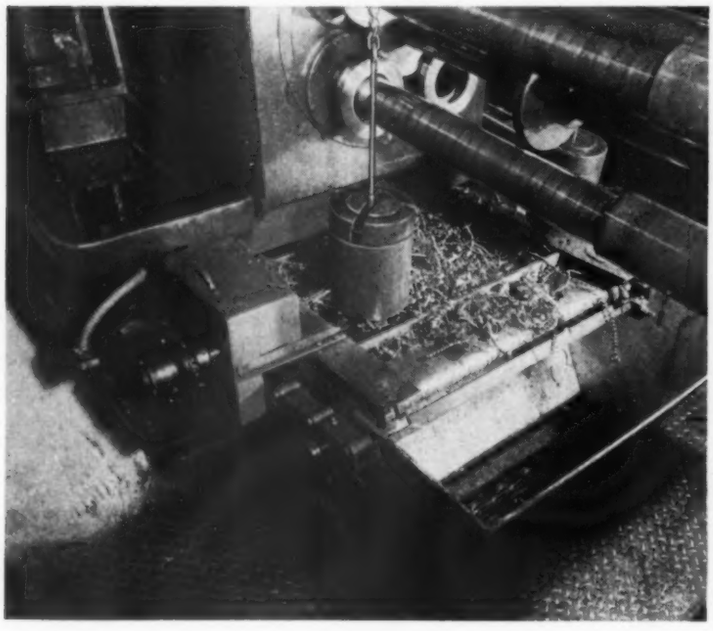
Soluble-Oil Coolant: to grinding machines.

Conveyorized chip troughs and pumps speed contaminated oils to a central reclamation and storage area for distribution to all plant production lines

All automatic screw and chucking machines are in line, above an underfloor chip conveyor which automatically moves chips to the reclamation area at the far end of the building. This conveyor is in a 437-ft. trench, 48 in. deep and 40½ in. wide, covered by ¼-in. steel floor-plate sections. Its sheet-steel trough has a 12-in. slope to the reclamation area. At its lower end it drains through screens into spouts which deliver cutting oil drained from the chips into a 2,000-gal. recovery tank.

The 24 x 6½ x ¼-in. steel flight plates on the chip conveyor are bolted at each end to the conveyor roller chains, spaced on 24-in. centers and shaped to clear the oil drain trough by ¼ in. Chips are carried along the trough to a discharge pan in the reclamation area and shoveled into baskets for the Tolhurst centrifuges. Remaining cutting oil is removed for recovery. Oil is pumped from the cutting-oil drain tank, through a fullers-earth filter to a 6,000-gal. storage tank for clean cutting oil, and pumped to the individual machines as required.

Clean cutting oil delivered from the reconditioning system is handled by the individual pumping systems supplied with the machines. Each automatic screw machine has a draglink chip conveyor in the base which automatically moves chips from the oil



Motor-driven draglink chip conveyors, mounted in the base of each automatic screw machine, feed chips from the machine sump to the main chip conveyor. Chips in the automatic chucking machines are hand-raked into similar chutes

Two 180-gpm. self-priming centrifugal pumps return used soluble oil coolant from each of the six drain pits to the reclamation tanks through overhead pipes. Used mineral-seal oil is returned in the same manner

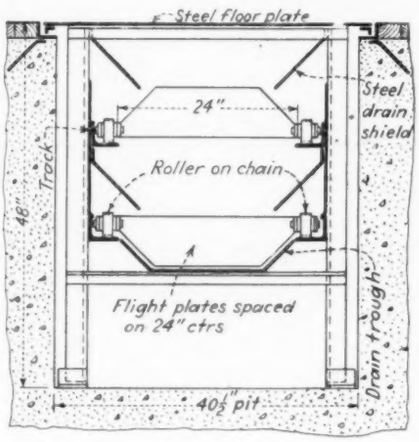
sump to the main chip conveyor through individual chutes. Oil carried with the chips to the discharge chutes is replaced by manually operated valves. At regular intervals, the cutting oil in each of the machines is drained out through a pipe line which connects the oil sump in the machine with the oil-drain trough in the under-floor chip conveyor. When this is done, the operator opens the supply line delivering fresh cutting oil and thoroughly flushes out his machine before closing the drain line and refilling the sump. Thus no residual sludge is delivered to the tools.

Automatic chucking machines, which have no chip conveyors, are arranged with the chip pans in each machine directly over the main chip conveyor. Chips are then hand-raked into chutes for delivery to the chip conveyor at frequent intervals. Otherwise, the handling of cutting oils to these machines is the same as for automatic screw machines.

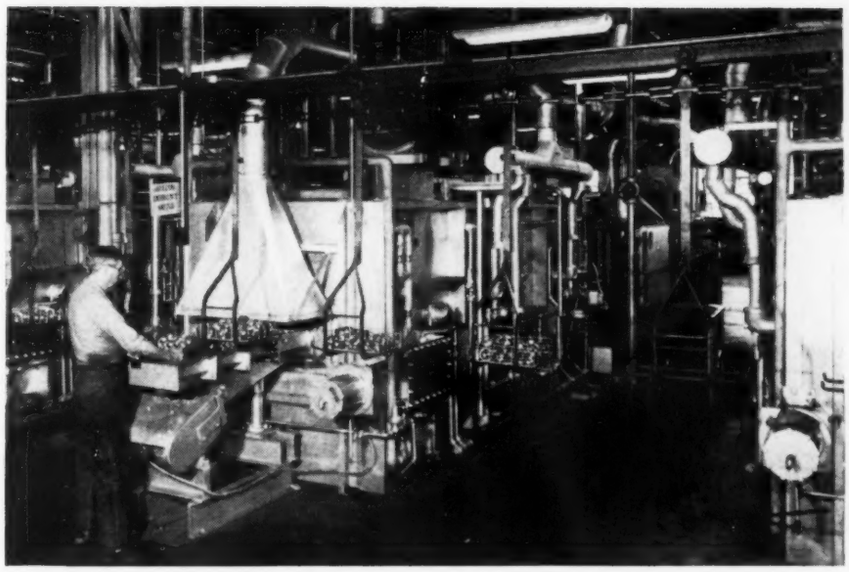
Protect Bearing Races

A sheet-metal chute on automatic-screw-machine and chucking-machine tool carriers prevents cut-off bearing races from falling into the chip sump and being carried into the chip conveyor. Occasionally a bearing race will miss the chute and get into the chip-recovery system. Such races are separated from the chips at the discharge pan when the centrifugal baskets are being loaded with chips.

Quenching-oil tanks in the three heat-treating lines are continuously replenished with clean quenching oil from a recovery and cooling unit in the reclamation area. This group of equipment consists of a 2,000-gal. recovery tank into which the oil is pumped from the quench tanks, a 6,000-gal. tank into which the oil is drawn from the recovery tank after being screened, and a cooling-water tower on the roof of the building. The 6,000-gal. tank is divided into a hot chamber and a cool chamber and oil is transferred from the first to the second chamber after passing through cooling coils. From the cool chamber, the oil is pumped back to the quench tanks in the furnace lines.



Chip conveyor can handle up to 1500 lb. of chips an hr., and has a maximum speed of 20 ft. per min.

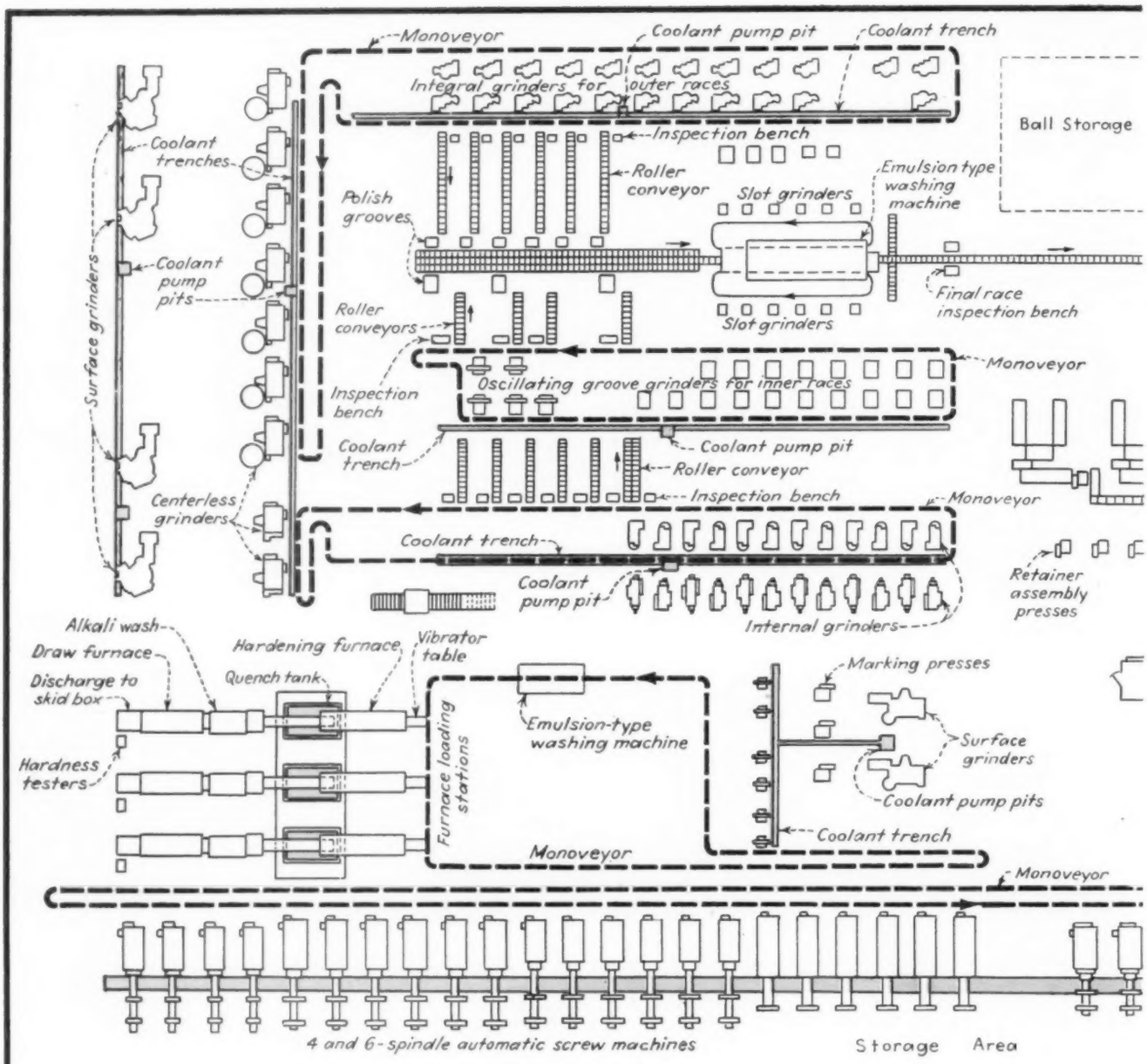


Quenching oil is recirculated continuously through the reclamation area and cooling units to the three heat-treating lines. Uniform hardness is more easily maintained as a result of the constant quenching medium temperature

Special centrifugal-head bearing-washing machines use filtered mineral-seal oil under pressure to clean assembled bearings

Bearing-washing machines flush any dirt or grit from bearings with clean, filtered mineral-seal oil. Oil drained from each of the washing machines flows into a trench under the floor to a pump pit where two 180-gpm. centrifugal pumps return the oil to the reclamation area through overhead pipes. This oil flows into a 6,000-gal. tank of unfiltered oil and is pumped through pressure filters into a second tank which delivers oil to the machines under 40 psi. pressure.

Of especial interest to plants employing large numbers of grinding machines is the system used to insure delivery of clean soluble-oil coolant to each grinder in this building. In no case is the coolant used over again in a grinding machine before it is returned to the reclamation section for removing all contaminants picked up from the grinding operation. Instead, two 500-gpm. centrifugal pumps deliver coolant under 40 psi.



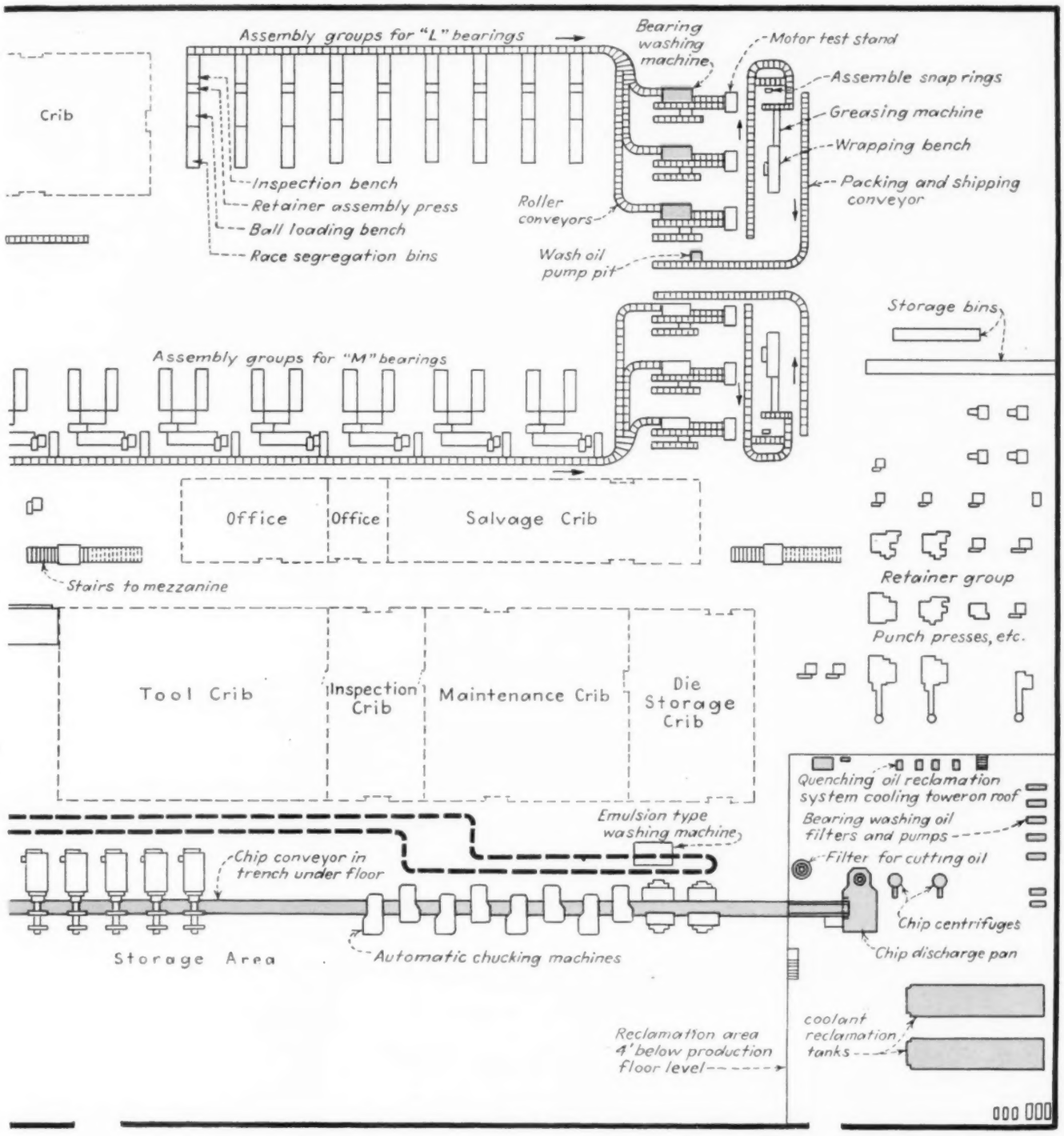
Used oils and coolants are drained and pumped from the heat-treating units, grinders, bearing washing and screw machines to the central recovery area. All supply lines are overhead to allow easy rearrangement of any group of processing units

pressure to each grinder from two settling and filtering tanks. Reducing valves cut this pressure to individual machine requirements.

Coolant is not held in the machine sump but drains directly into a discharge trench. Where the machines are designed with integral sump tanks and pump systems, this equipment is removed and the bottom of the sump drilled and tapped for a drain-pipe connection.

The layout sketch for this bearing plant shows a coolant drain trench for each group of grinders. In each of these trenches are one or two pump pits, each equipped with two Ingersoll-Rand vertical centrifugal sump pumps of 180-gpm. capacity. Pumps are controlled by an electric float switch so one pump is cut in when the coolant level is low and the second pump starts to operate when coolant level rises above a point where one pump can handle flow from the trench. Each day, the pump used as the standby unit is alternated, so pumps have equal wear. These pit pumps have been altered by plant engineers so they are automatically and continuously primed from the coolant lines which deliver clean coolant to the machines.

A separate discharge line is run from each machine to the nearest coolant-recovery trench. At the end of this line a screen catches chips or parts that might fall into the coolant sump of the machine and so



be carried into the discharge line. Coolant-return lines are designed without sharp bends to avoid settling of sludge.

About 40,000 gal. of soluble-oil coolant in 45-1 to 50-1 solution are carried in this system at all times, with 2,000 gpm. being passed through the filtering and recirculating units. Approximately 400 gal. of water and 8 gal. of oil are added daily to the coolant system. The system serves 92 grinders and 6 milling machines.

Ways of the machines are kept cleaner, settling of sludge on machine surfaces is minimized, and maintenance of grinding machines has been reduced materially by this centralized system. It has not been necessary to clean out the coolant sumps of any of the grinding machines in this department in almost a year. Under the old arrangement, it was necessary to clean the sumps of some machines once a day, others every two days, and others once a week—depending upon the capacity of the individual sumps. A relatively large staff was also required to keep these machines cleaned. In addition, finish-ground surfaces of high quality are obtained easily because the coolant always is clean.

Three 12,000-gal. oil-storage tanks under the floor of the reclamation area prevent production delays caused by shortages of cutting oil, quenching oil and mineral-seal oil. This eliminates drum storage on the shop floor.

Bore Tapers Off, But Not Chatter

Readers challenge suggestions, then offer additional methods for reducing chatter in boring a long taper in a brass piece

BY E. J. TANGERMAN
MANAGING EDITOR

WE, LIKE INDUSTRY, are in process of reconversion. While it taught us new techniques of teaching-in-print, war pre-empted paper, ink, equipment and manpower. Now we're building back, enlarging page size, making illustrations larger and clearer, showing more drawings as perspectives, simplifying and speeding our writing, adding special reports on key subjects and several departments familiar to old-timers, converting covers to four-color process, and so on. We hope you've noticed.

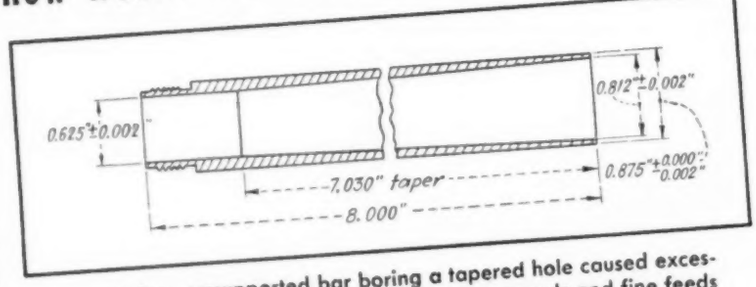
One step was to provide again the opportunity for readers to give their own suggestions. We passed on for subscriber comments David T. Armstrong's problem of boring a long-taper brass piece, shown below. Even though he held speed down, he experienced trouble from chatter as a result of the long overhang (8 in.) of the boring bar, and the diameter of the hole was too small to permit more adequate support of the bar.

Eight readers suggested precautions or alternate methods, which we published with a summary of Mr. Armstrong's problem. And right there the type louse*, publishing ancestor of the gremlins that plagued aviators during the war, got in his licks. He loused up those suggestions in two or three places. Fortunately, however, he's not very prolific—the rest of the issue was quite correct. When he had 250,000 or so words (mostly technical) to chew on, you'd expect more trouble. Be that as it may, the methods which were supposed to stop chatter actually increased it—from a dozen or more other readers who hurried to tell us our slips were showing.

To begin with, in briefing the problem, we said, "Brass bar stock, 0.937 in. in dia. . . . turn O.D. to 0.975 in." At which point, Lee L. Dodds of Kent, Wash., postcarded: "I am just an old, tired and retired machinist and my only source of contact with the modern shop is through the columns of the *American Machinist*. One of the oldest jokes in the shop is, 'The putting-on tool is lost.' But I see that it has been found. You take a bar 0.937 and turn it to 0.975 in. dia. Good trick if you can do it. I would like to see it described in an early issue." Note to Mr. Dodds: Prosaic shopmen now use weld beads or

* The type louse, genus *etaoin shrdlu*, is a tiny insect infesting print shops, and apparently deriving his sustenance from essential parts of letters. Our principal difficulties with him (or her) thus far have been evidenced in conversion of "tap" to "top," "drill" to "dull," "f.p.m." to "r.p.m.," etc. and in what appears to be misspellings of contributors' and readers' names and misquotation of their ideas. The insect is apparently immune to DDT, Ph.D., and even M.E.

How Would You Machine This Long Taper?



A long unsupported bar boring a tapered hole caused excessive chatter at high cutting speeds; low speeds and fine feeds produced a better finish but required two hours for the cut

DISCUSSION of the preferable method for boring this piece still rages. Four additional suggestions are offered here, and some earlier ones are criticized

sprayed metal, but we're experimenting with the type louse that turned an 8 into that 9. He put on 0.1 in. and made it stick through three proofreadings.

The real flood of letters, however, was generated by the suggestion of C. Stra that the job be mounted on a carriage fixture and fed by the lathe taper attachment past a flycutter in a tapered arbor, set on centers. Such a setup can only produce a straight hole through the work at an angle—until the bar jams in the bore.

When the letters of protest (a mild word for some of 'em) began to arrive, we wrote Mr. Stra. Replied he: "After rereading my own article, I must confess that I agree with your readers. I cannot for the life of me understand how I so foolishly made an error of this type . . . I would like to mention that at the time we were under a terriffic strain in reconversion and I evidently did not give the article enough thought. I do not offer this as an alibi, but as a statement."

Same here, Mr. Stra! We were just getting our first four-color covers under way, finishing the report on "How to Lubricate Metalworking Machines," and so on—up to our necks in our own reconversion. The editor who assembled and edited the replies was pinch-hitting for another more familiar with machining, and I checked the manuscripts bleary-eyed at the end of a long day. The warning bell in the back of my shopman's brain clanged—but I talked myself into believing the method would work. Before you scoff, let me quote Mr. Armstrong, whose problem started all this: "You pulled a boner here, but I forgive you. We made the same one originally in bidding on the job. This was the way we originally planned to do it—but it can't be done . . ." You see, the type louse, or a relative, gets even into editors' and shopmen's brains. Or perhaps, as E. P. Tucker, of Hartford, Conn., suggests, the Atomic Age has changed things, and that cranial itch of ours wasn't caused by a louse but was the result of a cosmic ray.

Increases Chatter

Only this could account, in R. M. Dyke's solution, for our substitution of "drag" for "forward" in the sentence: "Here the forces resulting from the *forward* angle tend to draw the bar into the work." Or again, for titling the drawing accompanying his item, "Forces for position of tool at top tend to draw boring bar into the work and dampen chatter." It should have been "increase digging and chatter."

Mr. Armstrong, incidentally, says he took advantage of toolbit angle as Mr. Dyke suggested and that gave him as little chatter as he had, but he still had to run the job slow. He also feels that it would take a Gargantuan machinist to have the muscle power to hand-ream a 7-in. bite with only 0.001 in. to remove as F. E. Ervin suggested. He avoided a reamer (suggested by Charles R. Stryler) for the job because of fear of seizing, although he toyed with the idea of one with staggered cutting edges. Changing bar position, as suggested by A. L. Litchford, didn't help, but Mr. Armstrong is impressed by the ingenious "tapered-slot" boring bar suggested by John Tyler. So are we.

It is with fear and trembling that we present these additional ideas on the subject received too late for inclusion in the previous group. If these are wrong, we disclaim responsibility, because we're writing this on New Year's Day.

Patrick M. Tabor of Pasadena, Calif., suggests that if the brass bar had been left at its original diameter of 0.937 in. until the bore taper was completed, the added thickness would have helped to dampen vibration. A "spud" turned with the same taper would easily hold pieces by friction while they were cut to length, turned and threaded. He further suggests that, while the run might not have been big enough to warrant cost of a two-fluted reamer, a used core drill could have been ground and backed off to make an impromptu reamer.

Charles Nickler of Warren Point, N. J., thinks the only trouble may have been with the toolbit. During the war, his shop had many particular jobs for Wright. He found that the less clearance under the cutting edge, the better the finish. In boring, he matches the bit contour to that of the bore wall, then grinds back a few thousandths for clearance. He feels it steadies the bar and says it has given beautiful finishes.

Bertram Ross of Bronx, N. Y., says this procedure will give a mirror finish quickly:

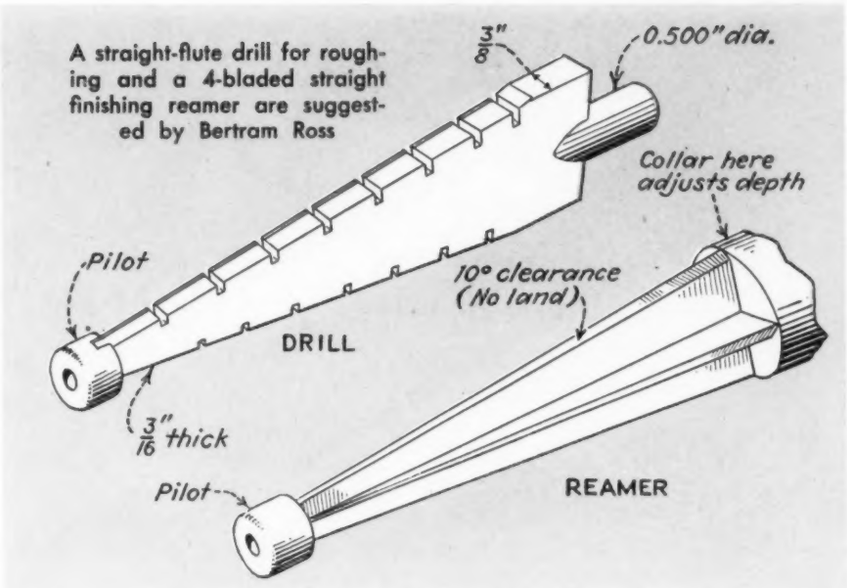
1. Drill and ream 0.625-in. hole in a turret lathe.

2. Use two-bladed flat drill like that sketched, flooded with coolant, to drill within 0.010 in. The undercut at the pilot must be well annealed and both edges should cut simultaneously. Blades are notched at 1-in. intervals to relieve strain.

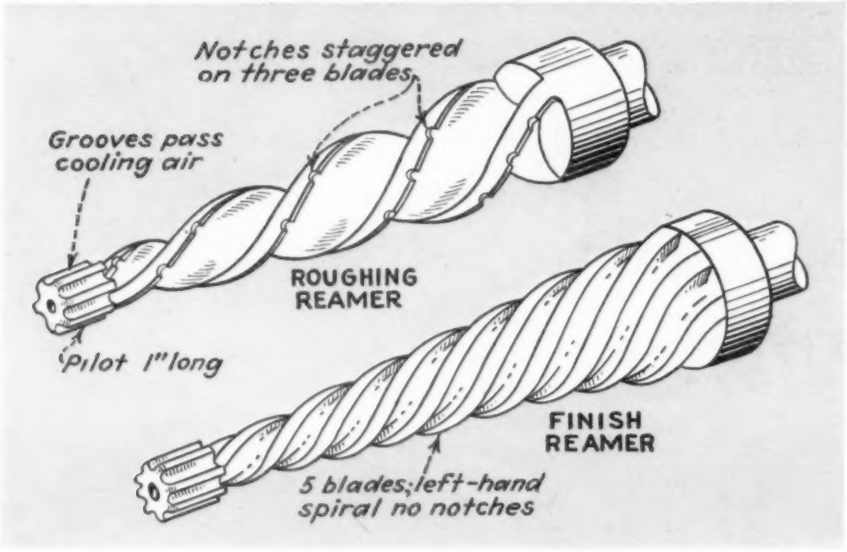
3. Clean up the final ten-thousandths with a four-bladed reamer that has neither blade lands nor notches. A collar stop prevents overreaming. The reamer is piloted at its outer end and held in a floating holder at the inner.

4. Turn end and thread.

5. Hold part on a tapered mandrel in engine lathe to finish O.D. Lee L. Dodds, previously mentioned, confesses to being an old timer (just starting his 75th year) and suggests a left-hand spiral-taper reamer of the type he first made in 1907 while



A straight-flute drill for roughing and a 4-bladed straight finishing reamer are suggested by Bertram Ross



Lee Dodds puts his faith in odd-bladed, left-hand spiral taper reamers, which he began to use almost 40 years ago

a foreman at Westinghouse. With it (he thinks the first of its type ever made), he reduced time for boring and reaming a female part for a circuit-breaker contact from 6 hr. to 8 min.

Says he: "I assume the job is to be done in a regular machine shop, with competent workmen, not with "war machinists" with 6-mo. training. Set up a bar-stock turret lathe to drill and ream the 0.625-in. hole. A competent operator should be able to do this with an accuracy of 0.010 in. Then use a 3-blade, taper, left-hand-spiral roughing reamer. Blades should have staggered notches. Feed should be very heavy. This reamer, with left-hand-spiral and odd number of blades, will clear itself readily without chatter.

"A 5-blade finishing reamer of the same type but without notches will finish the bore to a mirror surface. Both reamers have $\frac{5}{8}$-in. pilots 1 in. long, fluted to pass air introduced from a hose in the spindle. The piece should be mounted on a taper mandrel for finishing the outside. When the operator has gained experience with the job, time per piece should not exceed 10 min."

Mr. Dodds proved his sharpness by seeing in that same issue, in "Talking Shop," the quotation ending, "But when an editor makes a mistake, GOOD NIGHT!" which we inserted in anticipation of the trouble which has since befallen us. We are moved to quote at this point, the companion bit that once was framed in some country printing offices:

"A magazine is a great invention,
The authors get all the fame
The printer gets all the money
But the staff gets all the blame."

Which should be enough chatter to bore you on the subject of avoiding chatter in boring a long taper. We'd like, however, to add our own staff question, "Why bore the taper at all?" If the original 0.937-in. bar is bored to 0.623 in., reamed to 0.625 in., and polished, the taper can be pressed in. A spud or plug or desired taper with an end pilot can be turned to within 0.0003 in. of desired size and chromium-plated for wear resistance. The plug, coated with sheep fat, is pressed in to expand the bore while holding it straighter than machining can hope to do. Then the shank of the spud is gripped in a lathe, exterior turned and threaded and the spud removed by exterior heating or by a sharp tap on the pilot.

TIPS for Top Shop Men

21 You are not a judge, but a counselor. The sooner that attitude is clear to those who work for you, the sooner you'll have their confidence and respect — and the sooner you'll be able to clear up the personnel problems that disorganize departmental morale.

22 Take care of the "green hand." More potentially good employees have been lost through inattention than through any other cause. Remember your own experience when you first went to work—and extend a helping hand. Show him or her where things are, introduce operators of adjacent machines, explain "what goes on."

23 Maintain discipline—and set an example. Horseplay and foolishness caused more trouble than sabotage. An occasional joke or reminiscence relieves tension, but too many cause inattention, errors and lowered production. Don't expect to have privileges or take liberties because you're the boss—grown-ups imitate as readily as children.

24 Know the rules, company and union, and work for them, but don't quote them constantly as your authority. You are expected by both management and labor to be familiar with all regulations affecting yourself and your subordinates.

25 Plan work on both a day-by-day and a job-by-job basis. It is not enough to keep everybody continually busy—all must be busy on jobs which must be done. Certainly the job due today should be concentrated upon—but not to the exclusion of jobs due tomorrow. Keep jobs flowing smoothly—don't imitate a fire department that is so busy putting out fires it hasn't time to teach fire prevention.

26 Find out what the "new hand" knows, and why. You may have to put a good lathe hand to work on the bench to start, but you should know you're doing it. Be sure you've got a detailed knowledge of each worker's background. It may help in emergency, and proper placement builds morale and efficiency.

27 Pattern yourself after the successful salesman. Check back and follow up each employee, particularly the new ones. Find out what makes each one tick, and what makes him keep on ticking—or what would.

DO'S and DON'TS IN GAGE DESIGN

From a wartime vantage point in checking gages at a large plant, the author found many points of good gage design overlooked even by well-known gage producers

BY LOUIS DE L. BERG

A GAGE is of no value unless it satisfactorily performs its primary function: to determine if a part or assembly falls within the specified tolerances for the dimensions being checked. But there are several other features that should not be overlooked when designing a gage. These are: ease of inserting and removing the work, and repair or alteration of moving and gaging surfaces; rapidity of use; ease and accuracy of determining results; operator fatigue; and lastly, inspection by the gage checker with minimum effort before the gage is put into use.

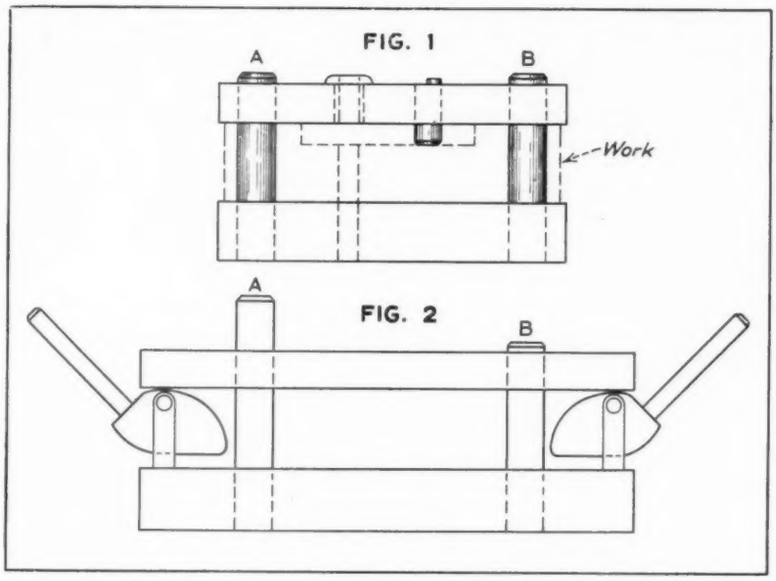


FIG. 1

FIG. 2

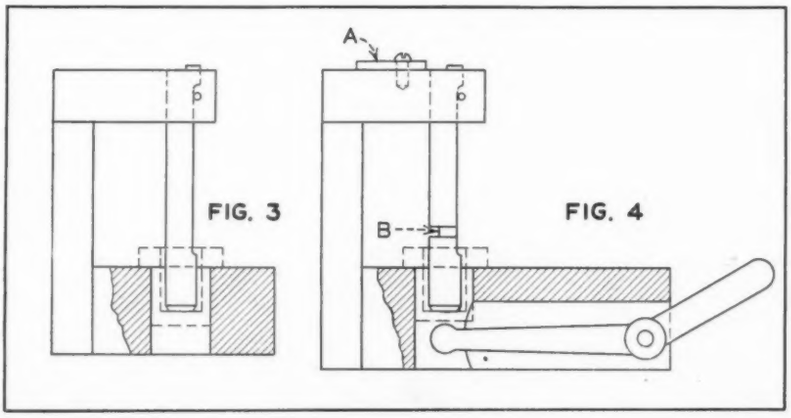


FIG. 3

FIG. 4

Ease of Inserting and Removing Work. No fixed rules can be laid down, but Figs. 1 to 4 show some general principles.

Fig. 1—Pins *A* and *B* locate the cover plate after the work has been placed in the main body of the gage. The cover plate has a flush pin and plug bushing. Experience has shown that if the pins are the same length, it is difficult to slip the plate easily upon them, and seizure may occur if the pins are a good sliding fit.

Fig. 2—Easy placement of the cover plate is effected by making pin *A* longer than pin *B* by the thickness of the plate. Pin *A* then acts as a guide to square the cover plate before engaging pin *B*. Cam lifters with a throw sufficient to clear the cover plate from pin *B* are a desirable feature, to prevent seizure on the pins.

Fig. 3—Small pieces that fit into receiver-type gages are difficult to remove unless the gage is provided with a quick-acting ejector. This flush-pin gage for checking the depth of a blind hole must be picked up and inverted to remove the piece. And if it is a snug sliding fit, the part must be forced out with a rod.

Fig. 4—Two features can be incorporated in the gage to assist work removal. First, an ejector can be provided at slight additional cost. Second, put a free-turning eccentric washer at *A* and machine an eccentric groove *B* in the flush pin. To unload the gage, lift the flush pin and engage the washer in the groove, then operate the ejector. The pin lock can be spring- or hand-operated as desired.

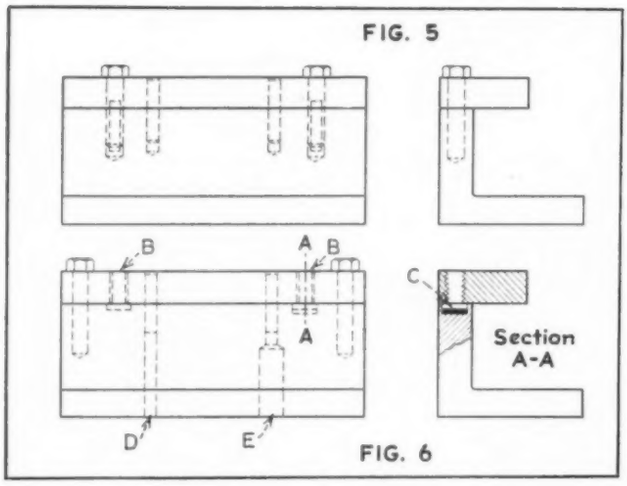


FIG. 6

Repair or Alteration of Gages. Nearly every gage is subject to repair due to wear or needs alteration to suit another part. When gages are fairly complex, and built up of several elements, they must be taken apart. But too often the construction is such that dismantling consumes several hours of the gage maker's time, and there is possibility of damage if force must be used. Certain improvements, at slight extra cost, will often make the gage much better.

Fig. 5—Plates are commonly attached to gage bodies with dowels and capscrews. Upon dismantling, it may be found that the dowels are such a tight fit in both members that a hammer and chisel must be used to effect separation. If serious damage is not done, the parts will at least be disfigured and marred.

Fig. 6—Screw pressure can be used inexpensively to separate the plate from the body. Drill and tap two holes *B-B* in the cover plate close to the dowels and counterbore a recess in the body just below the holes. When the cover plate must be removed after the gage has seen service, two oval-point setscrews are screwed into the tapped holes, thus jacking the plate off the dowel pins, or lifting the plate with the pins from the gage body. If the body is iron it is advisable to set hardened steel buttons as shown at *C* in the sectional view. Further, the removal of press-fitted dowel pins from the body is troublesome, unless through holes as at *D* are used. And if the through hole is too deep for drilling with a stock size drill, a larger hole *E* can be drilled part way through from the back.

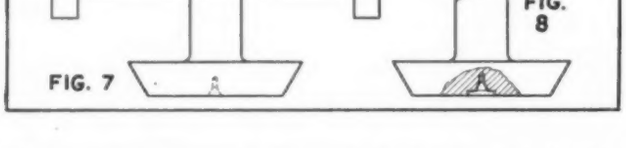


FIG. 7

FIG. 8

Fig. 7—An uncommon form of flush-pin gage is that used for measuring the relationship of a flat surface to a countersunk or tapered hole. Ordinary procedure for making such a gage involves putting centers in a piece longer than the finished length, finish grinding the cone and stem, cutting out the top center as at *A*, and finishing the step to the desired length. In time, the cone is worn or damaged, and it becomes necessary to repair the pin for size and concentricity. With one center removed, this task is well-nigh impossible.

Fig. 8—By making the centers with counterbored recesses, the objection to the construction shown in Fig. 7 is overcome. The recesses tend to preserve the edge of the center from damage, and the center is left in the small end so that the finished pin can be checked and reworked when necessary. True, the gaging surface of the pin does not present an unbroken surface, but as gaging is done only on the outer rim, the usefulness of the gage is not impaired. If the cone diameter is worn beyond the allowable tolerance, it can easily be reground and chromium-plated to size.

Taper plug gages of this type should always be provided with a master ring gage. The additional cost of the master ring is soon absorbed by the time savings in use as compared with measuring over rolls of known diameter. And if a work gage and an inspection gage are in use, it is difficult to keep them in accord with rolls, whereas they are easily checked with the same master ring.

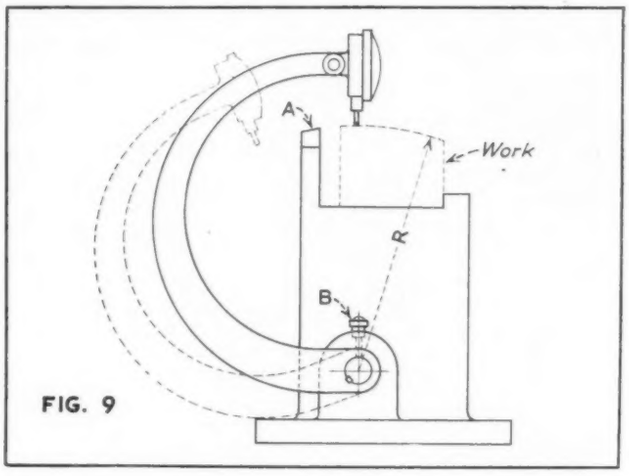
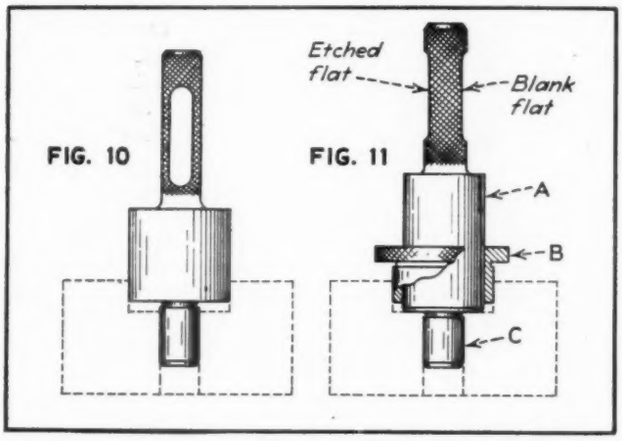


FIG. 9

Fig. 9—Wear of moving gage parts can often be prevented by providing suitable means for lubrication. These should be located so they are easily seen and keep dirt out of the bearing surfaces. The illustration shows a typical gage for checking a radius on the work. An indicator is carried on a swinging arm pivoted at the radius *R*, the indicator being set to zero by the master setting block *A*. Constant swinging of the arm soon wears the shaft in its bushing. An oiler *B*, if kept filled, reduces wear at the pivot to a negligible amount.

Fig. 10—Rapid wear is common for one-piece plug gages used to check the concentricity of a counterbored recess with a central hole. Reason: Slight eccentricity of the counterbore will cause pressure of the large diameter of the plug against the side of the recess.

Fig. 11—Wear can be reduced practically to the vanishing point by making the concentricity gage in two sections: the main body *A* and the sliding collar *B*. In using the gage, the collar is slid back and the plug *C* is entered in the small hole. The collar is then advanced to the counterbore and will enter it without undue force or wear if the concentricity is within the



tolerance. Diameter of the collar should be of proper size to enter the counterbore but sufficiently smaller to allow for permissible eccentricity. A second flat (left blank) on the knurled handle is a convenience to the gage inspector, who then has space for marking his symbol and date of issuance.

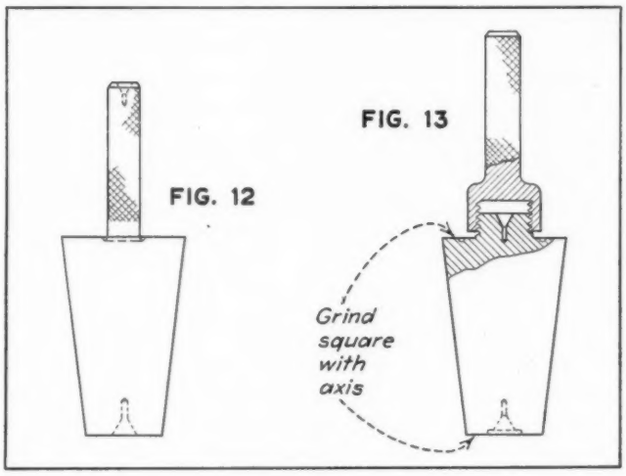
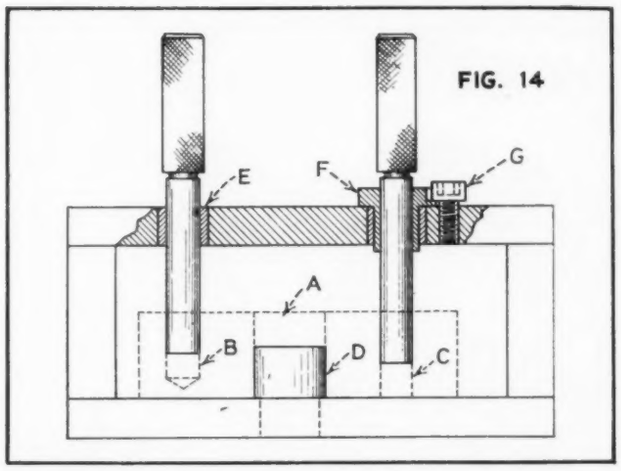


Fig. 12—The handle of a heavy taper plug gage (5 lb. or more) is often sprung in service, making it impossible to place the gage between centers for checking the taper and roundness for wear. Further, the handle is frequently in the way of measuring machines when checking the size over rolls.

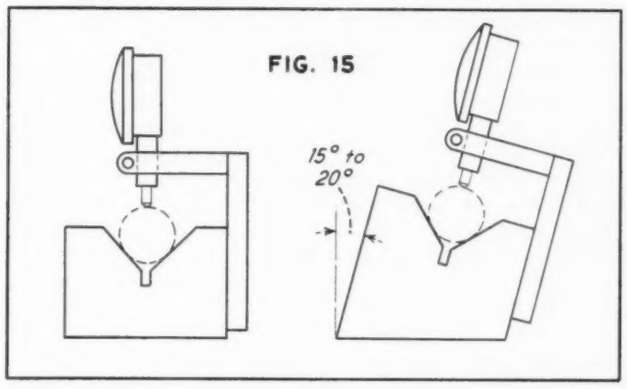
Fig. 13—A two-part design makes for easier and more accurate checking of heavy taper plug gages. The centers are in the gage body, and both are protected against damage. By specifying that both ends of the body be ground square with the axis, it is possible to take readings over rolls at predetermined distances for an accurate determination of the size.

Fig. 14—When several dimensions must be checked in one gage, one or more details will wear out faster than others. The gage should be designed for quick replacement with duplicate paths, or made so that the quick-wearing portion can be removed as a unit for machine work. In the latter case, the remaining dimensions can be checked and the temporarily "inactive" dimension measured by another means.

In the hole-location gage illustrated, the relations of holes *A*, *B* and *C* are measured by placing the piece on



the plug *D* and inserting plugs in bushings *E* and *F*. In time, both the bushings and plugs become worn. Replaceable bushings, as at *F*, should be used. Locking screw *G* should be a snug fit in the tapped hole in the plate and brought down just enough to touch the bushing. Otherwise, there is danger of cocking the bushing.



To Overcome Operator Fatigue. Considering the rapidity with which many gages can be used, care should be used to eliminate factors that contribute to operator fatigue. Eye fatigue will contribute to slowing down quite as much as muscular fatigue.

Fig. 15—If a gage such as shown at left is used at bench level, the operator must stoop and read the indicator at an awkward angle. Inaccurate readings may result and the operator's eye and body muscles will tire rapidly. Slant the base 15-20° as shown at right.

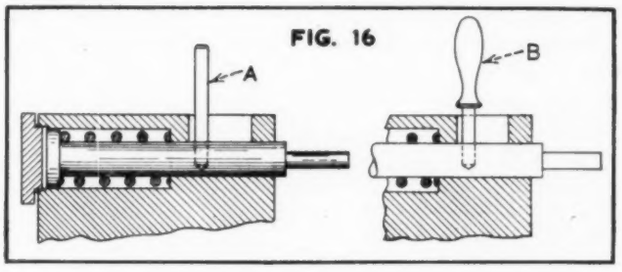


Fig. 16—The small retractor *A* makes the operator's fingers sore after some use, especially in the case of girls. Taping the fingers is a makeshift, slows down inspection and lowers morale. The small handle as at *B* costs little.

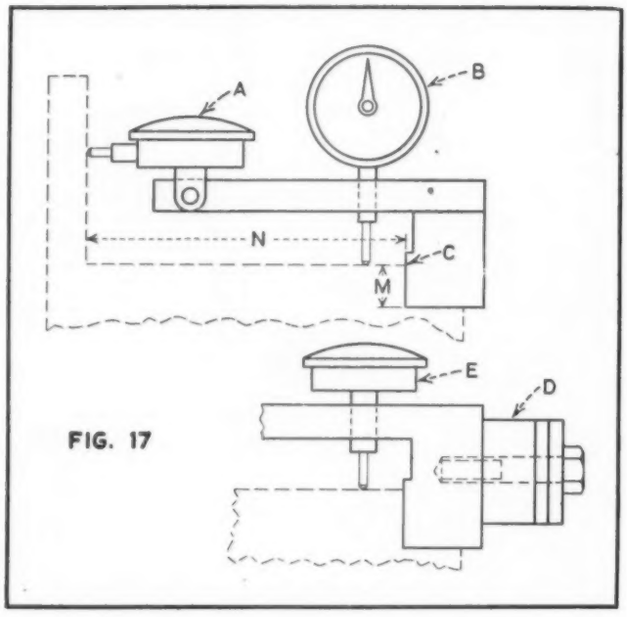


FIG. 17

Fig. 17—Indicator *A* measures the face to face dimension *N* and indicator *B* the depth *M*, both indicators being set to zero by a master block. This gage is top heavy and great care must be taken to obtain accurate or repeat readings, because of the tendency of the carrier block to pivot about *C*. Sectional weights *D* should be attached until the proper balance is obtained. Since the operator must read indicators *A* and *B* from two directions, the latter should be changed to one like that at *E*.

General Pointers on Gage Design. It is a common fault to neglect (in connection with gages which require setting the indicator to a master) to mark the gage or master with the master setting and the allowable indicator-reading tolerances. For example, if the *N* dimension, Fig. 17, is 4.745 in. plus 0.0005 in., minus, 0.003 in., the master gage should be marked: "Master setting 4.745 in., indicator tolerance plus 0.005 in., minus 0.003 in." Without such marking, the inspector does not know if the master setting is the basic dimension or the high or low tolerances.

Some gages are too heavy properly to feel the difference between close go and not go tolerances. This is especially true of snap gages with specially designed anvils for measuring grooves or tapers. Better results might be obtained by substituting an indicator snap gage.

Some thought expended on the problems of the gage checker will often save him much time and insure a more accurate check. Work or construction holes are usually indicated thus: "2¾-in. work hole." When the gage is received for checking, it is generally found that the hole is several thousandths, more or less, from the specified fractional dimension. After a fruitless search to find a plug or arbor that fits the work hole, the checker may have to have one made. The fault can be corrected as follows:

The hole dimension can be specified: "reamed hole to fit standard plug or else furnish centered arbor, gage fit in hole." Frequently, the gage maker has made an arbor for his own use, but he naturally does not send it with the gage unless told to do so. The above option allows him to make the hole to standard size or else supply the arbor.

Make the work hole ½ in. in diameter if there is room for it. Sometimes it is necessary to hang the gage from a pin for checking purposes. A ⅛- or ¼-in. arbor is too light for suspending a heavy gage.

One side of gages with square bases should be finished parallel or square with some centerline. The gage maker will ordinarily do this, but it does no harm to specify it on the drawing.

Consider the physical limits of the gage checker's equipment. Perhaps he has a dividing head with a 12½-in. swing. Try to keep within such limits when laying out holes radially or angularly spaced. Remember that gages are checked many times during their life, and little refinements of this sort will pay for themselves.

Make provision in the gage design for secure attachment of masters, feelers and other loose parts when the gage is not in use. Not good design is a round hole in the base into which a loose plug is dropped. Specify a spring clip or a screwed attachment. Then it is not the designer's fault when an inspector claims a gage cannot be used, because the setting master is lost.

Models Help in Tooling Plans

BY JOHN R. GODFREY

FULL-SIZED wooden mock-ups are receiving broader use in the planning of fixtures and tooling for new products. Few will argue against the claim that mock-ups present a better visualization for the holding and machining of parts than blueprints. The full-sized pattern shows every projection and its relation to the body of the piece, making it easier to plan fixtures, determine clamping methods, decide best machining procedure and select the right tools.

Blueprints made it possible to reproduce drawings easily and cheaply. Prior to blueprints, many shops used samples or models from which the workman obtained dimensions of the piece to be made. Present-day mock-ups are far ahead of those earlier models.

Full-sized models have many advantages. For example, they can be used to show a designer how modifications would make it easier to hold the piece, to machine it without using special tools, or to assemble it without complications.

The aircraft industry uses mock-ups extensively in planning new work. Some machine builders have had complete models made of new machines to determine the most convenient locations for control handles. A few carry the model-making plan to small parts in studying tooling. The method appears to be finding increased favor among tool engineers generally.

ROUND TABLE

Should Machinists Be Licensed?

"Ed, I just got a new man who ought to be in the toolroom, judging by his toolbox. He doesn't look old enough to have the kit he has, so I suspect somebody passes 'em on to him or he picked up the whole business from some toolmaker's widow. I'll bet that's the way he turns out, too—he'll have to be something spectacular to live up to his toolbox."

"Digging at me again about that old argument of ours, eh, Al? Well my grandmother always used to say, 'You can judge a man by the company he keeps.' I still believe you can usually judge a machinist by the tools he keeps."

"And I say you're nuts, Ed. Nowadays, anybody may turn up with almost any kind of tools. In a lot of companies, they won't let a man buy and use his own. Lots of good machinists haven't been able to get the best tools—the ones they'd normally buy—for the last five years. And a lot of shysters picked up good tools because they were working for companies with high priorities. Tools mean less now than they ever did."

"You persist in your notion that I think the brand name is the only gage, don't you, Al? Well, I don't and never did. What I said was that you can't believe any man's story on his experience or ability; you've got to try him out. The only ready check you've got on his opinion of himself is the kind of tools in his kit and how he keeps 'em. If they're good tools, well kept, and of the kinds a toolmaker uses everyday, the chances are that he's a toolmaker, or he wouldn't have bothered."

"Unless he just likes to have good-looking tools—like the maid who took her boss' grapefruit peels home to make her own garbage look stylish. What's more, if you happen to give a lopsided machinist jobs he's familiar with, it may be months before you find out he doesn't know all he ought to—and then he's been on the job so long you hate to fire him."

"Listen, Al, any good foreman can tell by the way a man tackles his first job or two how good he is, and you know it. He doesn't have to wear a government stamp or carry a certificate that he graduated from some apprentice course."

"I'd like to believe the same way you do, Ed, but I can't. I've been fooled too often by slick operators. My idea is that there ought to be an examination and state license for machinists just like there is for stationary engineers, architects and consultants. Then you'd know the guy with a license at least had some background. No license would ever show whether he has brains and sense, but it would show he meets some standard of training."

"Unless his brother is the examiner or somebody sold him the answers to the questions. Nope, Al, you worry about licenses and certificates; I'll stick to judging by what I see with my own eyes."

"Well, Ed, you'd better adjust those cheaters of yours then—or get somebody to work out your intelligence test for toolmakers."

Would state licensing overcome the trial-and-error methods that have always been the way to test a new man? How would such licensing affect union contracts? Can you judge a machinist by the tools he keeps, allowing something for the present unusual situation? How about "intelligence" and "orientation" tests? Your ideas and suggestions will be helpful to others. Those published will be paid for

Acetylene Proves Economical In Flame-Cutting Steel

BY DR. G. V. SLOTTMAN
APPLIED ENGINEERING DEPARTMENT, AIR REDUCTION SALES COMPANY

IN RECENT YEARS, the practice of joining and separating metals by flame has become recognized in all industries where steel is worked or where machines and equipment made of steel must be maintained. However, the question of which commercial heating gas is most satisfactory and economical to use with the oxy-flame welding or cutting process is sometimes raised, and the technical considerations involved are of interest to all users of the process.

The choice of heating gases necessary for oxy-flame welding or cutting lies between acetylene, an unsaturated hydrocarbon gas, on the one hand, and the saturated hydrocarbon gases on the other. (The term, hydrocarbons, refers to organic compounds which contain only carbon and hydrogen in the molecule. A saturated hydrocarbon may be defined as a compound which does not contain any free valences and to which no hydrogen atoms or their equivalent can be added, i.e., which contain neither a double nor a triple bond. This type includes city gas, natural gas and certain petroleum distillates: ethane, propane and butane.)

In tests conducted on these two types, it was discovered that the saturated hydrocarbon gases require complete combustion with oxygen to generate their maximum flame temperature. These gases are known as exothermic fuels because, when burned, they absorb heat to complete their own decomposition and consequently do not produce the full heat of the carbon and hydrogen they contain. Acetylene, however, being an endothermic gas, which has absorbed heat in the process of manufacture, gives off this extra heat during combustion to be added to the heat generated by its carbon and hydrogen constituents and reaches flame temperatures in the order of 6000 F.—some 1000 F. higher than the maximum flame temperature of the saturated hydrocarbons—with an oxygen-gas ratio of less than 50% of that theoretically required for complete combustion.

While other gases can be used for the purpose, the fast rate of heating and low oxygen-gas ratio show savings for acetylene not reflected on a Btu. basis

These tests further proved that the various fuel gases used in steel cutting cannot be compared on a straight Btu. or heating value basis, because of their varying flame temperatures and because of the correspondingly varying heating efficiencies which these gases develop when burned with oxygen. When a series of practical cutting tests were conducted using the saturated hydrocarbon gas, propane, in comparison with acetylene, not only was a greater amount of propane required to do the same amount of cutting, but the use of propane increased the total oxygen requirement considerably.

To determine further the operating characteristics of the hydrocarbon cutting fuel gases under controlled test conditions, an exhaustive study has been made of city gas, natural gas, propane and acetylene using a variety of commercially available oxy-fuel gas cutting torches and mild steel plate varying in thickness from ½ to 4 in. Three-hose torches with separate cutting and preheating oxygen inlets were used to check the quantity of gases consumed, so a clear distinction could be made between the oxygen consumed in cutting the steel and the oxygen used in burning the fuel gas.

The operation of steel cutting can be separated into two phases: (1) preheating an area of steel surface to the ignition temperature with an oxy-fuel gas flame and (2) severing the steel under the preheated area with an oxygen stream. Oxygen is used at two separate points in this process; to burn the fuel gas and to sever the steel.

In conducting these tests, which involved over 700 separate determinations, the investigation entailed a study of: (1) the effect of the oxygen-fuel gas mixing ratio on the rate

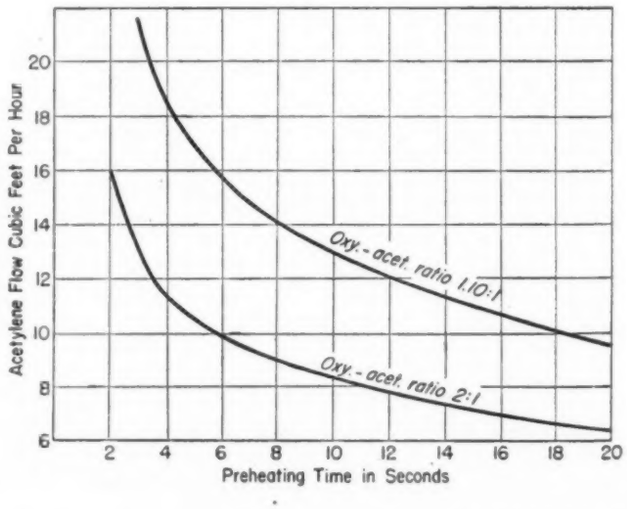


Fig. 1—The rate of acetylene flow and the oxygen-gas mixing ratio affect the preheating time, as shown, when used with a commercial cutting torch

of heating; (2) a comparison of the rates of heating of various oxy-hydrocarbon flames; (3) a study of the cutting-oxygen requirements; and (4) a study of the total oxygen consumptions required to produce equivalent cuts in steel with these various hydrocarbons as heating gases.

Experimental evidence demonstrated the following principles: (1) that per unit of heat developed, oxy-acetylene flames preheat steel faster than any other commercially available fuel gas; (2) that per unit of heat developed, acetylene requires the least amount of oxygen for its combustion; and (3) that where equivalent cuts are made in steel, the total oxygen consumption with acetylene is considerably less than with any other commercial fuel gas.

Mixture Affects Speed

Fig. 1 shows the results of a study of the effect of the oxygen-acetylene mixing ratio in the preheating flames of a commercial cutting torch, and of the effect of the rate of acetylene flow on the speed of preheating steel plate. With a mixing ratio of 1.10 volumes of oxygen to one volume of acetylene, and with an acetylene flow of 9.5 cu. ft. per hour, 20 seconds were required to bring the steel plate to the ignition temperature. By increasing the acetylene flow to 21.5 cu. ft. per hour, and maintaining the mixing ratio at 1.10 to one, the preheating time was reduced to 3.0 sec. By varying the oxygen-acetylene mixing ratio to 2.0 to one, the acetylene flows required to produce ignition of the steel in given times were plotted in the lower curve, Fig. 1.

Similarly for all oxy-fuel gas flames, there is an optimum oxygen-fuel gas mixing ratio which will develop the shortest preheating time for a given fuel-gas flow. In the case of the saturated-hydrocarbon fuel gases, such as city gas, natural gas and propane, this optimum mixing ratio will be close to the theoretically calculable mixing ratios for complete combustion, which are: for city gas, 0.75 volumes of oxygen per volume of city gas; for natural gas, 2 volumes of oxygen per volume of natural gas; and for propane, 5 volumes of oxygen per volume of propane. Because of the fact that acetylene develops its highest flame temperatures at an oxygen-acetylene ratio of 1.7 to one, the optimum oxyacetylene ratio is considerably lower than the 2.5 to one, required for the theoretically complete combustion.

These relationships are shown in Fig. 2 which represents a plot of the

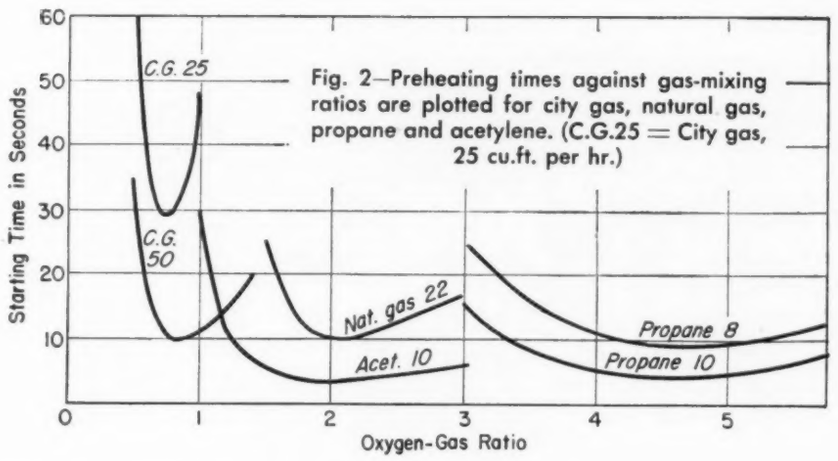


Fig. 2—Preheating times against gas-mixing ratios are plotted for city gas, natural gas, propane and acetylene. (C.G.25 = City gas, 25 cu.ft. per hr.)

preheating times against the gas-mixing ratios for city gas, natural gas, propane and acetylene. From these data it will be seen that for a city-gas flow of 50 cu. ft. per hour, and with an oxygen-city gas mixing ratio varying from 0.5 to one to 1.25 to one, the preheating times will decrease from 35 sec. to a minimum of 10 sec. at the mixing ratio 0.75 to one, and will then increase to 20 sec. as further oxygen is added to the flame. With a city-gas flow of 25 cu. ft. per hour, the preheating times naturally become longer, as less heat is being delivered to the plate. The shape of the preheating-time-oxygen-gas ratio curve, however, is similar to that obtained for a flow of 50 cu. ft. per hour, reaching a minimum preheating time of 28 sec. at a mixing ratio of 0.75 to one.

Similarly, for natural gas, with a flow of 22 cu. ft. per hour, a minimum preheating time of 9.5 sec. is reached at an oxygen-natural gas ratio of two to one. For propane, with a flow of 10 and 8 cu. ft. per hour, the minimum preheating times are 9 and 5 sec. respectively, at an oxygen-propane mixing ratio of 4.5 to one. In the case of acetylene with a flow of 10 cu. ft. per hour, a minimum preheating time of 3 sec. is reached with a mixing ratio of 1.7 to one.

In spite of the high heating values of propane at 2310 and of natural gas at 1000 Btu. per cu. ft. the relative volumes of gas required to obtain the same starting times as with acetylene in no way correspond to a strict thermal comparison with the heating value of acetylene at 1433 Btu. per cu. ft. Thus, for a comparison of acetylene and natural gas, it would be assumed from the relative heating values of these two gases, that 14.3 cu. ft. of natural gas would do the work of 10 cu. ft. of acetylene. From the data of Fig. 2, however, it is evident that to produce the same speed of operation as with acetylene, 28 cu. ft. of natural gas burned with 56 cu. ft. of oxygen, are needed—the extra gas consumption with natural gas being due to the lower flame temperature and the lower heating efficiency. This relationship for the standard hydrocarbon fuel gases, city gas, natural gas and propane, is shown in Table I, which includes the gas and oxygen volumes required to do the same work of preheating as 10 volumes of acetylene burned with 17 volumes of oxygen.

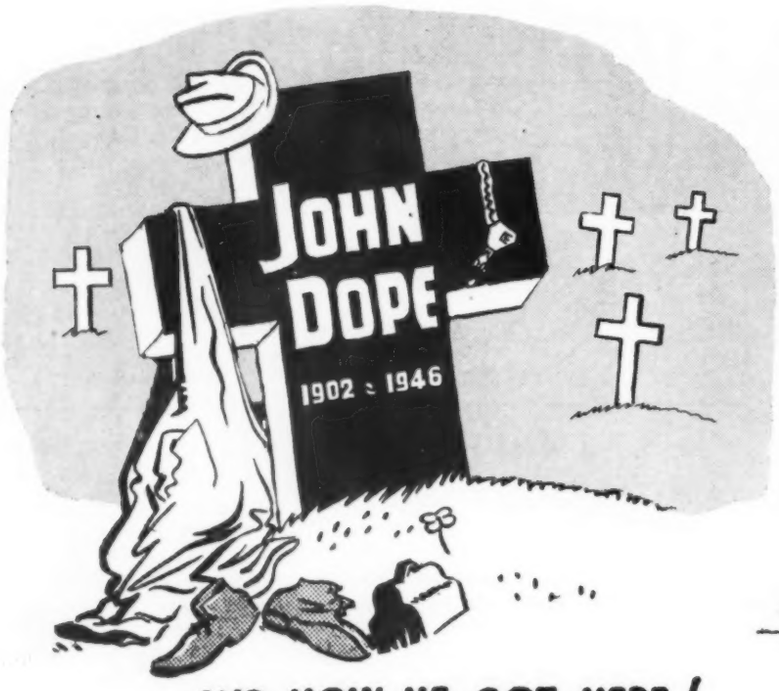
TABLE I—RELATIVE VOLUMES OF FUEL GASES TO PRODUCE EQUIVALENT RATES OF HEATING

Fuel Gas	Volume of Fuel Gas Cu. Ft. per Hr.	Volume of Oxygen Cu. Ft. per Hr.
Acetylene	10	17.0
City Gas	75	56.3
Natural Gas	28	56.0
Propane	12	54.0

Another feature shown by the figures in Table I is the relatively large volume of oxygen required to burn the saturated hydrocarbon gases. Despite the low price at which these low-temperature gases are available, the cost of this extra oxygen weighs heavily in favor of acetylene.

Where a slow rate of heating is required the value of a high temperature flame is of secondary importance to the Btu content of the heating gas. However, where emphasis must be laid on speed of heating, as in the preheating of steel plate for cutting, the oxy-flame temperatures are of primary importance in selecting the relative quantities of the gases used.

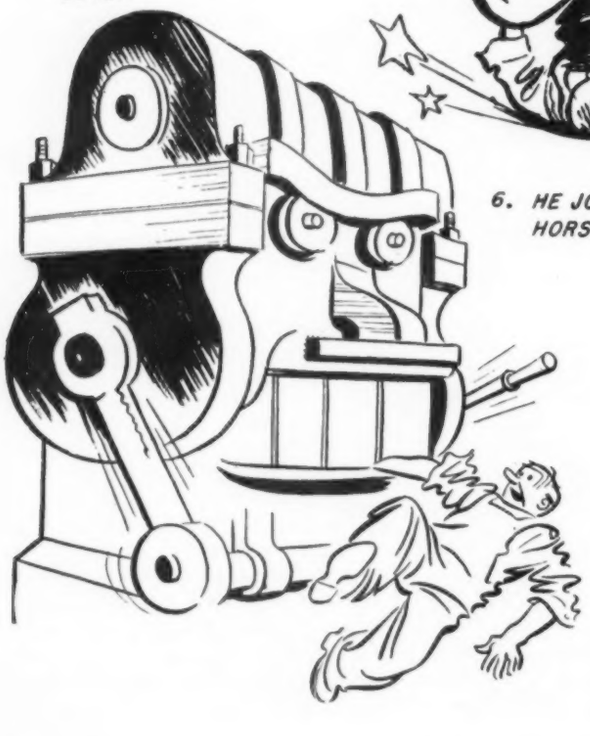
This is the fifteenth and concluding article of the series.



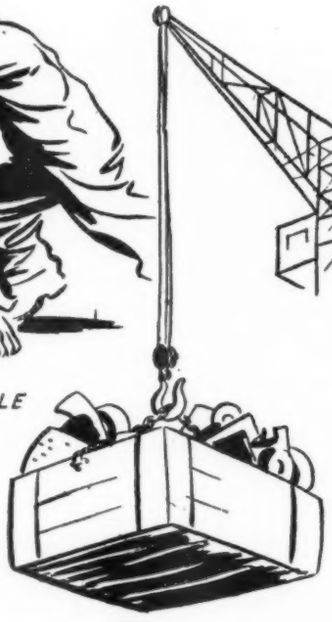
. . . AND HOW HE GOT HERE!

1. HE WENT TO WORK WITH LOOSE FLOPPING CLOTHES AND DIDN'T CHANGE THEM...

5. HE STUCK HIS HAND INTO HIS MACHINE AND KICKED THE TRIP LEVER



6. HE JOINED THE BOYS IN A LITTLE HORSEPLAY - JUST FOR FUN



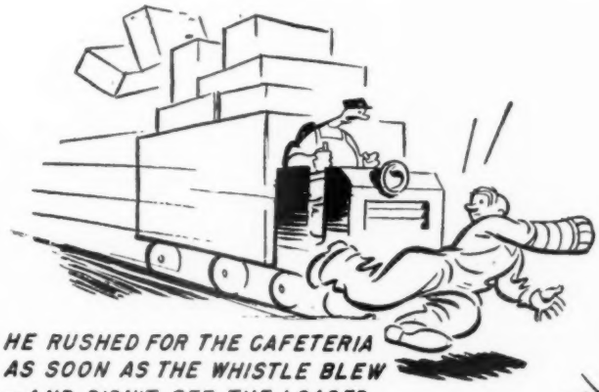
7. HE TOOK A LITTLE STROLL UNDER A LOADED CRANE

2. HE FORGOT...

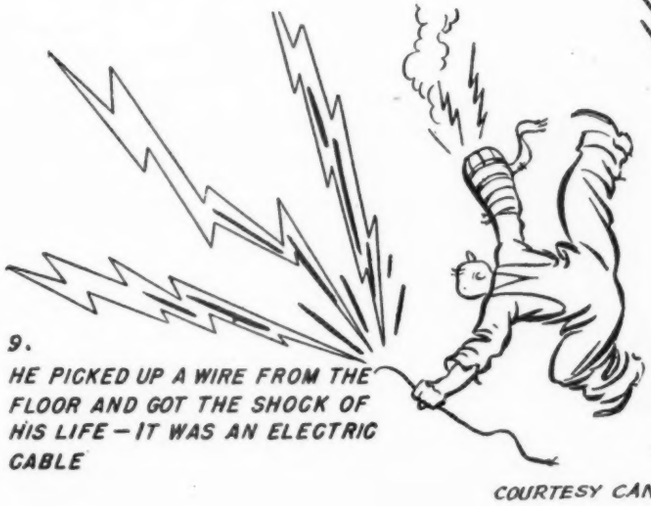
THE GLOVES THAT PROTECT HIS HANDS
THE GOGGLES THAT PROTECT HIS EYES
THE HAT THAT PROTECTS HIS EYES (?)

3. HE LIFTED A BOX AND PUT THE STRAIN ON HIS BACK INSTEAD OF ON HIS ARMS AND LEGS

4. HE TRIPPED OVER EQUIPMENT HE HAD LEFT LYING AROUND



8. HE RUSHED FOR THE CAFETERIA AS SOON AS THE WHISTLE BLEW – AND DIDN'T SEE THE LOADED CAR COMING DOWN ON HIM



9. HE PICKED UP A WIRE FROM THE FLOOR AND GOT THE SHOCK OF HIS LIFE – IT WAS AN ELECTRIC CABLE

10. HE DROPPED HIS CIGARETTE INTO A PILE OF INFLAMMABLE WASTE

COURTESY CANADIAN INFORMATION SERVICE, OTTAWA .....

• WHAT YOU SHOULD KNOW ABOUT INDUSTRIAL ELECTRONICS—IV

Electronic Tubes as Rectifiers

WHEN WE USE electronic tubes as rectifiers to change alternating current to direct, we apply the first of the tube's two basic functions—to act as a check valve.

Electronic tubes possess this ability because the current-carrying electrons are released only by the cathode. Therefore, flow can be only from cathode to anode, never in the reverse direction.

Electronic rectifier tubes are available in many sizes to meet the many requirements of industry. Basically, these tubes can be classified according to three types, known commercially as the kenotron, the phanotron and the mercury-pool tubes. Mercury-pool tubes include the ignitron and the large multi-anode tank tube.

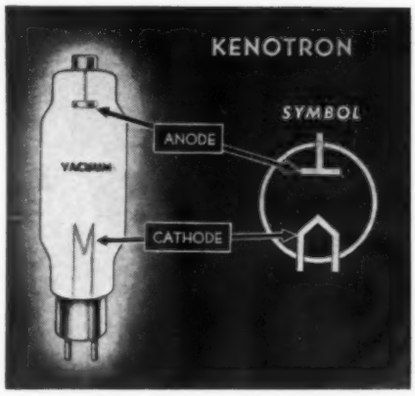
We can picture the kenotron as the simplest form of a two-element high-vacuum tube. It contains a cathode which emits electrons, and an anode which collects them, both sealed in a high-vacuum tube.

Wide Range of Size

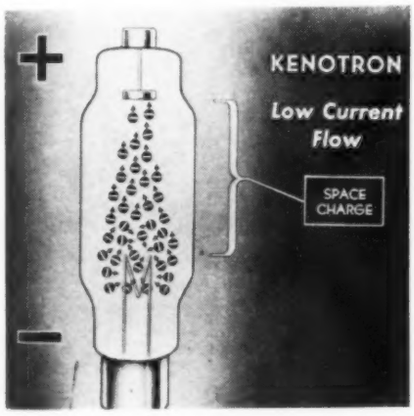
In some cases the kenotron is called a "rectifier tube," or sometimes a "diode," because it has two elements. However, industry is rapidly accepting the name kenotron. As we know them today, kenotrons vary in size from small walnut tubes, used for sensitive electronic control circuits, to giants capable of rectifying the tens of thousands of volts needed for electrostatic processes.

The kenotron in practical use is limited to applications requiring low current flow, usually a fraction of an ampere. This is because of an inherent characteristic called "space charge," which impedes the flow of electrons through the tube.

Better to understand "space charge," let's take a close look at the action inside the kenotron. To begin with, when the cathode is heated, electrons boil off in great numbers, forming a congested area or cloud which is densest around the surface of the cathode. Electrons, being negatively charged particles, repel each other and hinder the flow of other electrons from cathode to anode. This repelling action is called "space charge" and is greatest where the electrons are densest.



The kenetron, the simplest two-element high-vacuum tube, is indicated by the symbol at the right



The "space change" impedes the flow of electrons through the kenetron tube because the negatively charged particles repel and crowd each other

Because of the space charge effect, it takes a thousand volts to produce a one-ampere flow in a kenetron

The electrons "crowd each other" to produce the space charge characteristic in the kenotron, and so even with a relatively high voltage, only a small current can flow between cathode and anode.

For example, in a large kenotron tube, the anode must be raised to a positive potential of a thousand volts in order to attract sufficient electrons to produce a current of only one ampere. Similarly, even smaller kenotrons designed for lower currents require relatively high anode voltages for their full rated output.

Some Common Uses

Kenotrons, then, are primarily designed for high-voltage applications that require only a low current flow. For example, kenotron rectifiers supply the high voltage and low currents required for electro-static processes such as the precipitation of flyash from the smoke of power plants and incinerator operations. Similar kenotron rectifiers provide high dc. voltages needed in the manufacture of high-octane gasoline. In this system an electrostatic process recovers valuable catalysts formerly lost.

Other kenotron rectifiers are used in equipment for cleaning air electrostatically. This process removes soot, fine dust, and even oil vapors and welding fumes that escape most mechanical cleaners.

Testing equipment for cables and insulators calls for high dc. voltages but little current, and provides another application for kenotron tubes. Kenotrons are also used for low-voltage applications such as radio receivers and public address systems which require only low currents.

These small kenotrons are used for low-voltage, low-current requirements because of their simple construction and low cost. Most of these smallest kenotrons also include two cathodes and anodes in the same tube, as a further saving in space and cost.

Based on a sound slidefilm in the General Electric industrial electronics course.

Practical Ideas

Six Special Tools from English Shops

Here are several ideas reproduced from *Production and Engineering Bulletin*, publication of the British Ministry of Labour and National Service. These devices all are from factories in England, and many originated in suggestion plans similar to those used in the United States.

Bench Vise Attachment for Beading Small Tubes

Various methods are used in beading tubes, but the simple device illustrated in Fig. 1 has proved particularly effective when applied to tubes of small diameter. The tool was designed by an employee of a London aircraft firm

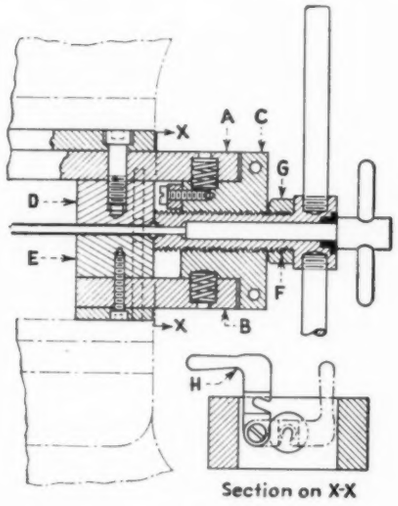


FIG. 1

and is claimed to offer a number of advantages compared with equipment previously used. It is mounted in a bench vise.

Two jaws *A* and *B*, the former replacing a jaw of the bench vise, are hinged to a crosspiece *C*. These jaws carry a pair of blocks *D* and *E*, which are bored to take the pipe to be beaded, and the inner end of this bore is formed to serve as a die. Compression springs hold the jaws open when the vise jaws are separated.

A screw *F* threaded through the crosspiece *C* is formed at its free end to provide the other half of the die and operates against the end of the tube. This screw is turned by a pair of handles, and its movements is limited by a stop *G*. The screw is also bored to take a plain cylindrical mandrel which extends into the tube and fits closely in its bore, thus preventing the metal from collapsing.

The sequence of operations in producing a bead on a tube is as follows: With the jaws *A* and *B* open, the screw *F* retracted within the crosspiece C, and the hinged stop *H* lowered, as shown by the chain-dotted lines in section *XX*, the tube is pushed over the end of the mandrel until it bears against the stop. The jaws are then closed to grip the tube and the hinged stop is raised. The screw *F* is next spun round by means of the two handles so that it engages and applies pressure to the end of the tube, thus forcing it to conform to the die cavities in the two blocks *D* and *E* and in the end face of the screw. The screw is turned until the stop *G* bears against the crosspiece *C*, when the bead is completed. The mandrel is then withdrawn from the tube and the jaws are opened.

This idea is the subject of Patent Application No. 18503/43.

Time and Labor Saved in marking Out Tube Joints

When two tubes or pipes have to be joined at a given position and angle, the process of developing the line of junction by geometric methods is slow and laborious. The scribing tool, Fig. 2, was designed by a mechanic in the Midlands for the making of jigs used in the production of *Spitfire* wings.

Tube *A* is clamped in position on V-blocks, of which only one is shown. The other tube, *B*, also rests on two V-blocks. An angle bar *D* is clamped to tube *B*. It is adjustable so that the lower arm grips the tube *B* but still allows the scribing unit to be rotated freely.

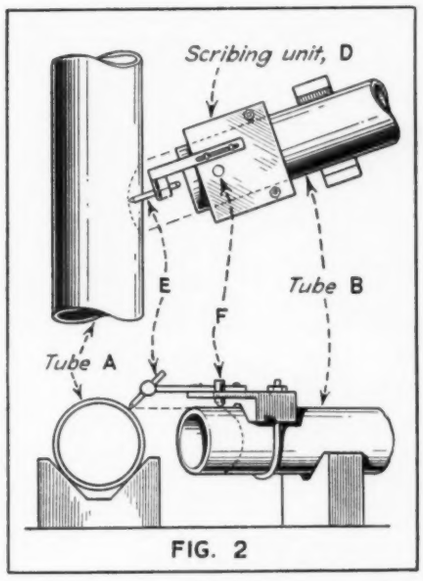


FIG. 2

A sliding rod adjustably mounted on the plate *C* carries a scriber *E*, and on the side of the V-shaped plate is mounted another scriber *F*, which is spring-loaded.

In operation, the tube *A* is clamped into position on its V-blocks. The V-blocks supporting tube *B* are then positioned so that the tube is set at the required angle in relation to tube *A*. Scriber *E* is set so that its point is level with the top of the tube *B* and in contact with tube *A*, and scriber *F* is adjusted so that its point bears on the surface of the tube *B*. The scribing unit is then rotated round the tube *B* so that the point of scriber *E* marks a projection line on the tube *A*, and the scriber *F* produces a corresponding line on tube *B*.

This idea is the subject of Pat. Application No. 2233/45.

A Combined Clamping and Drilling Grip

The device shown in Fig. 3 is used for accurately spotting and drilling rivet

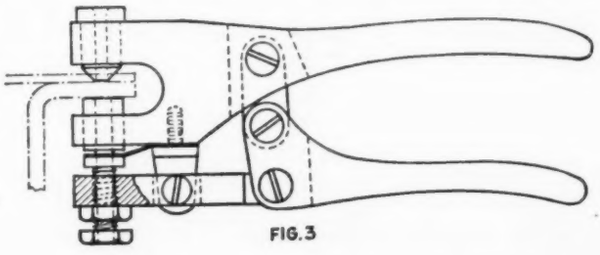


FIG. 3

holes from, for example, a semi-circular cover plate, previously drilled and countersunk, into a similarly shaped angle member to which the plate is subsequently riveted or bolted.

A flanged drill bushing in the upper jaw, conical at its other end, fits into the countersunk hole in the plate and through the lower jaw passes a sliding bushing with an annular groove, about 3/16 in. from one end, into which fits the forked end of a flat spring. Pivoted to a lug screwed into the frame is a short rocker arm which carries an adjusting screw that bears on the sliding bushing and controls its position. The opposite end of the rocker is connected by a toggle link with the two handles.

In operation, the drill bushing is located in the countersunk hole in the cover plate and the handles are closed. The plate is thus gripped against the angle member, the adjusting screw having been set so that the toggle link locks the tool in this position without further support.

Advantages claimed for the tool are: (1) the holes are drilled normally to the curved surface and are in line with the countersunk holes in the plate and (2) chips are prevented from entering between the plates, because these are tightly gripped together.

If used with parts in which the drilled holes are not countersunk, a bushing with a flat end may be used in the upper jaw. This is located by inserting a dowel through the bush into the pilot hole in the drilled plate previously to gripping the handles of the tool.

Improving the Finish of a Reamed Hole

Modification of the reamer used, as suggested by one of their operators, was responsible for overcoming a North Midlands firm's difficulties in machining the bores of steel ram rods accurately and with a fine finish. The operator also recommended a simple modification in the sequence of operations. The trouble experienced was due to eccentricity of the bore of the drawn tube in relation to the centerless-ground external surface, and to the tool mark remaining in the bore after finish reaming.

The procedure now followed is, first, to hold the tube in a collect chuck and take a starting cut in the bore, 0.990 to 0.988 in. diameter, for a depth of 1 in., using a single-point tool.

The bore is then opened out to the same diameter for a length of 8.25 in. with the four-bladed reamer shown in Fig. 4, which is mounted in a floating holder.

The feature of this reamer is the provision of four phosphor-bronze supporting pads *A* soldered to the head of the tool. The pads are ground in position to the same diameter as the blades and locate the reamer initially from the surface bored by the single-point tool, which runs true with the outside diameter. They continue to provide support during the remainder of the cut. A similar tool, without the bronze pads, is used to finish the bore to 1.002 to 0.998-in. Apart from the four bronze supporting pads the reamer is of the same design as those normally used by the firm. The job is carried out on a standard turret lathe.

An Air Jet as an Aid in Turning Internal Grooves

The chips produced by the cut was causing a lathe operator some trouble in machining a groove in the bore of a component produced in quantity. He suggested the use of the device shown in Fig. 5 for blowing the chips from the bore.

An air valve mounted on the cross-slide is operated by a spring-loaded plunger fastened to a bracket at the rear of the carriage. When the cross-feed moves the tool over to the work, the air-valve button is depressed by the plunger and compressed air is blown into the hole automatically, leaving the operator's hands free to operate his machine.

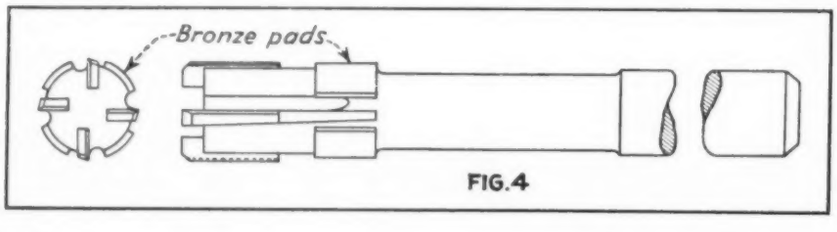


FIG. 4

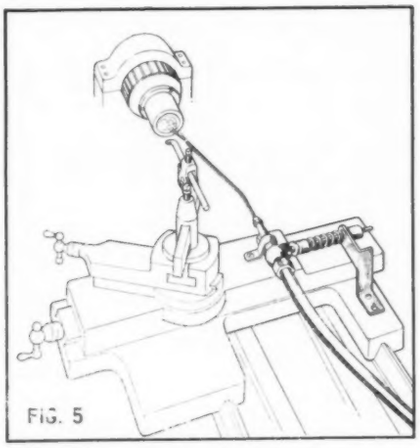


FIG. 5

New Life for Worn Chasers

A method of using chasers worn too short for tangential-type dieheads was suggested by a machine operator in a factory in the North-West.

The tool, Fig. 6, is in two parts, the square-section body being bored to take the shank of the chaser-holder. The body is mounted in the tool

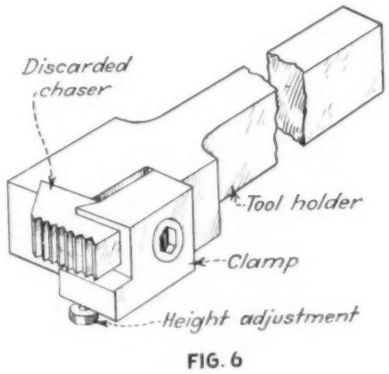


FIG. 6

rest of the lathe in the usual manner, and being split lengthwise on one side enables the holder to be securely gripped when the clamping screws are tightened.

A vertical dovetail slot is provided in the head of the holder, one side of the dovetail being formed by a clamp held in place, and tightened on to the chaser by a socket-head screw. Vertical adjustment is provided for by the screw fitted into a tapped hole in the corner of the dovetail and protruding into the slot below the chaser.

The tool can be used for cutting either right- or left-hand threads by turning the holder to left or right in the body before clamping it in the tool rest. Setting marks are provided on top of the chaser holder, with a corresponding index mark on the body of the tool.

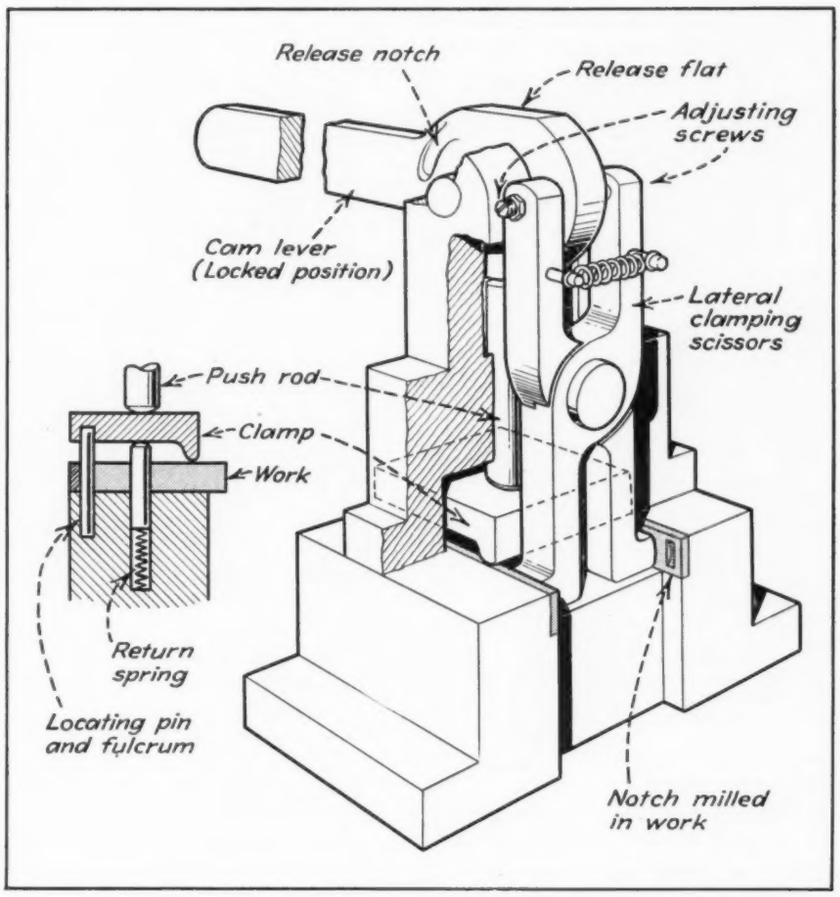
Milling Fixture Has Horizontal And Vertical Clamping

L. KASPER

A large number of U-straps required milled notches in both legs. These parts are light and flexible, so this fixture was built to position and hold the work in two directions with one motion of the cam lever.

A single cam provides the control. It is a circular disk flattened at one point on its periphery to release the vertical pressure (radial) and indented on each side symmetrically to release the horizontal pressure (axial). Vertical pressure is transmitted from the cam through a vertical plungger to a clamp plate which bears on both legs of the piece. This plate is supported at its fulcrum by the guide pin which positions the work. With pressure and support at two single points on the center axis of the clamp plate, the action is equalized on the two legs. Opposing the vertical plunger beneath the clamp plate is a spring return plunger.

Lateral clamping is effected with a vertical scissors whose lower members force the legs of the part against the sides of the fixture. Two setscrews in the upper ends provide for individual adjustment between the cam-face notches and the legs of the part.

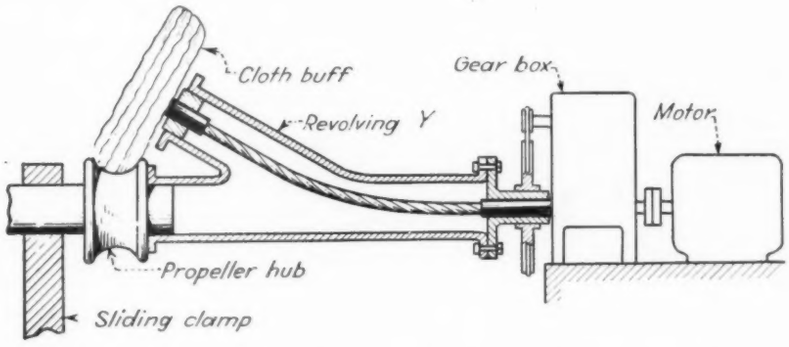


Dual-action cam in this fixture has radial and axial followers for clamping flexible part in two directions

Epicyclical Rotation Burrs Unwieldly Parts

Large machinery components requiring a precision high-speed finishing operation on some circular projection can be handled as suggested here. These forged aluminum propeller blades couldn't be conveniently rotated so a slowly revolving soil pipe Y rotates the buffing wheel around the work. The motor is coupled to a small double worm reduction (about 100 to 1) speed reducer. The high speed shaft coupled to the motor at one end, projects sufficiently to serve as one bearing for the Y and its pulley before the flexible part begins. The work has a stationary pilot fitting into a bushing in the Y for support at the outer end.

Confining a flexible shaft to a fixed orbit in this way has greatly expedited this job, and such a machine could readily be equipped with various attachments to provide a wide range of diameters and cutting angles.



Slowly revolving soil-pipe Y guides this flexible-shaft buff for finishing a circular section on a part which could not be rotated

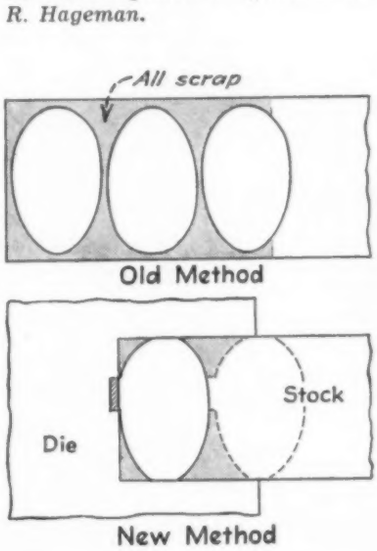
If YOU have a Practical Idea—

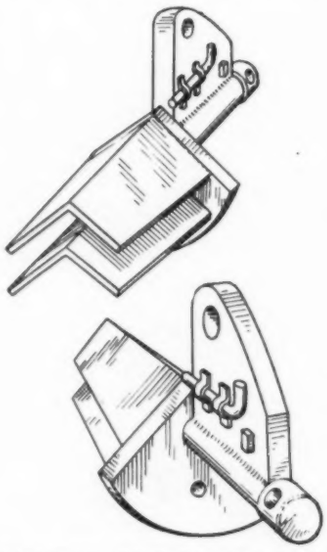
These pages present outstanding contributions from our readers. The material has been selected on the basis of practicality, universal interest and broad application, or for its originality.

If you know of a particularly handy tool or shop setup, whether of your invention or not, why not let us know about it? We pay for your efforts as long as the material is exclusive to us.

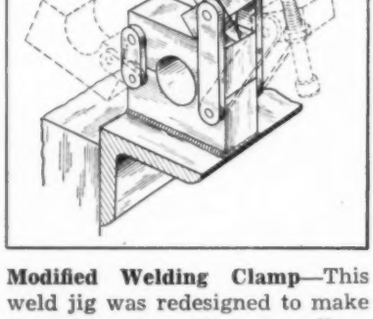
Portable Power Stirrer—To mix plating solutions in the New Orleans plant, hand paddles, formerly used, proved slow and tiring. Better results in one-third the time are now attained by using a power-stirring device on the lower end of a long shaft driven by a portable hand drill. *W. J. Smith.*

Improved Blanking—A redesigned die permitted the use of narrower stock and closer spacing between pieces. Since a drawing operation follows, the slight projection does not introduce extra work. The scrap, in separate pieces, was easily conducted away and used for small jobs which was not economical before. An inclined press and gravity feed further simplified the process. *H. R. Hageman.*





Angle-Iron Stacker—Two short pieces of angle are welded to one side of a quadrant, as shown, permitting the stock to fit between. The other side carries a heavy pin which serves as the axle for the swivel-lifting plate. A slide bolt and several holes provide various locking positions. With two of these hooks on a sling, large pieces of angle iron can be unloaded and stacked in a single operation with absolute safety. *Haig Torosian, Calship.*



Modified Welding Clamp—This weld jig was redesigned to make it positive in action as well as dependable enough to be used as the principal part of milling and boring fixtures. The usual cam lock was replaced by an Allen screw which could be adjusted at any time in a few minutes to give the holding effect desired on the job at hand. *G. W. Reeves, Beech Aircraft Corp.*

Bearing Puller — Conventional wheel pullers were almost useless in removing the bearing covers of railroad passenger-car lighting generators. The heavy disk and studs either could not be gripped at all because of narrow clearance or the concentrated stress would break off the flanges. The barrel of this puller is a piece of heavy pipe large enough in diameter and length to fit over any armature shaft with the flange up against the bearing cover. A 1⅛-12 screw exerts direct thrust on the armature which is distributed evenly over the six studs. Since the tool was made, work has been speeded up and breakage entirely eliminated. *Sunnyside Yards, Pennsylvania Railroad.*

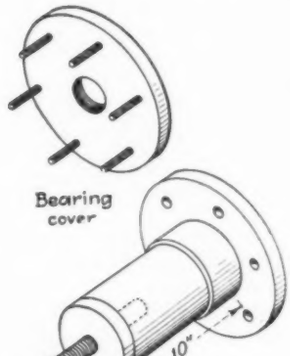
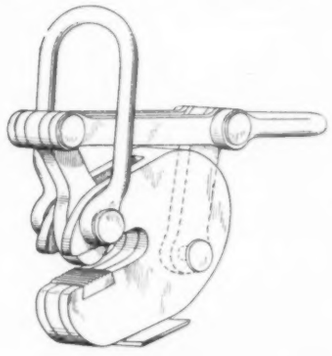


Plate Puller — The handling of large plates between furnace and bending slab has been greatly improved with this wedge clamp. Pushing on the horizontal shackle opens the jaw and with plate in place, pulling the shackle pulls the plate too. The large vertical shackle is for lifting when the plate is clear of the furnace. *L. W. Hall, W. A. Jones Construction Co., Inc., Brunswick, Ga.*



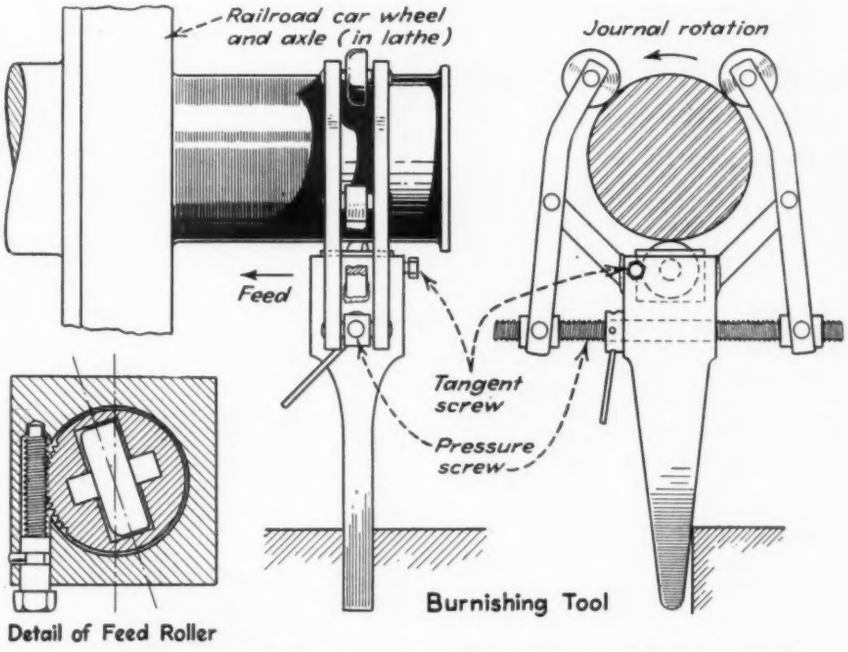
Triple-Roller Burnisher Prolongs Lathe Life

The Pennsylvania Railroad has developed a way to eliminate all wear and straining of lathe sliding surfaces during burnishing operations. The tool, now in universal use on the system, replaces a single-roller tool. The latter, despite its smaller size and simplicity, was difficult to use and very hard on lathes.

Here, clamping pressure is quickly adjusted with the right and left hand screw and in addition, feed is automatically controlled with a steering roller. This is carried in a cylindrical cup which has a gear sector cut in it. A tangent screw then, by turning the plane of the roller, quickly and positively adjusts the rate and direction of feed.

To get an idea of the tool's value it may be well to describe the job. All railroad rolling stock is supported on axle journals, in the case of Pennsylvania passenger cars, 5½ in. in diameter by 11 in. long. These require frequent refinishing to insure the roundness and concentricity required for vibrationless riding.

Refinishing is done in a 4-carriage, interrupted-bed, center-drive wheel lathe using water to cool the toolbit. A single cut is usually all that's necessary and one pass of the burnisher, flooded with oil, reduces the diameter about 0.002 in. more, leaving a hardened, highly polished surface. The rollers have edge radii to correspond with the shoulders of the journal. Burnishing is started near the outer end with only light pressure applied. The steering roller is first adjusted to feed the tool against the outer radius. Here, clamping pressure is increased to the maximum and the feed reversed. As the burnisher starts, the handle of the tool bears on the carriage but without thrust. Longitudinal carriage feed is engaged so the handle doesn't slide off the carriage.



Right and left hand screw pushes burnishing rollers together, eliminating radial thrust on the machine; the tangent screw turns the center roller, providing sensitive feed control

Tailstock Couplings Allow Controlled Power Drilling

Two readers, Joseph R. E. Paquin and Oscar Craft, have submited individual ideas on ways to couple the lathe tailstock to the carriage.

When drilling a number of holes in the lathe on short-run production, it is often desirable to have a power feed for the tailstock. This is especially true when drilling deep holes with the drill held in a chuck in the tailstock in the conventional manner. Operator fatigue then plays an important part in production and the uneven hand-feed necessitates the sharpening of the drill far too often.

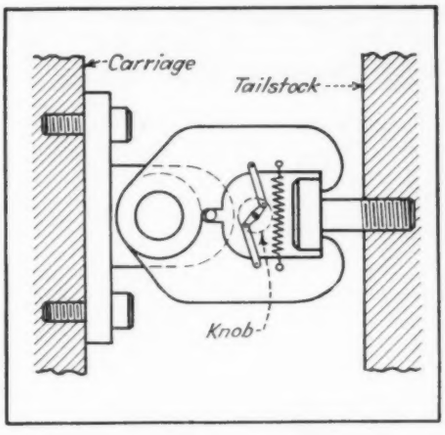


Fig. 1—For light, deep drilling, the tailstock clamp is released, and the carriage is backed up until it automatically couples to the tailstock. Feed is then engaged

Mr. Paquin's solution is shown in Fig. 1. The coupling consists of two hooks which are held in closed position by a tension spring. The unit is kept lined up axially with the tailstock bolt by a small pin at the end of the carriage clevis, which is bolted as close to the ways as possible. The toggle link opens the jaws and a raised knob is provided for turning the center-link.

Mr. Craft's system depends on the shape of the carriage. When the carriage is backed off close to the tailstock, Fig. 2, a flat spring latch deflects until it clears the dowel on the tailstock. Then, when the carriage is

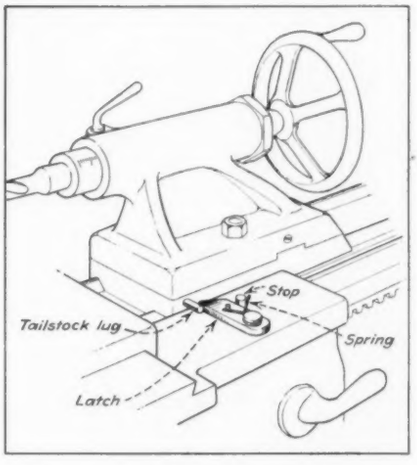


Fig. 2 — Here, the coupler is mounted on one side of the carriage and engages automatically when backed past the tailstock

advanced, the latch transmits the load from the projecting pin in the tailstock to the stop pin in the carriage.

Jig-Boring Huge Bearings In Re-Vamped Lathe

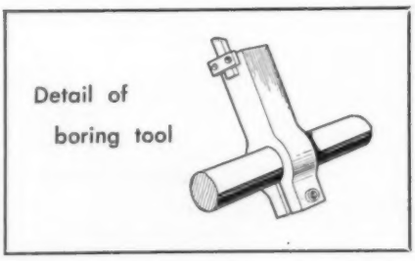
TOM RODGERS,
Maintenance Machinist
Slave Falls Hydroelectric Plant
Pointe Du Bois, Manitoba

Lignum vitae lower bearings for our four (soon to be eight) 12,500-hp. Morris turbines have to be relined frequently since only 0.030 in. wear is permitted. The total cost of sending them to the factory was about $500, of which a large amount was transportation. Each bearing is 44 in. long by 21.506 in. bore and weighs 1¾ tons.

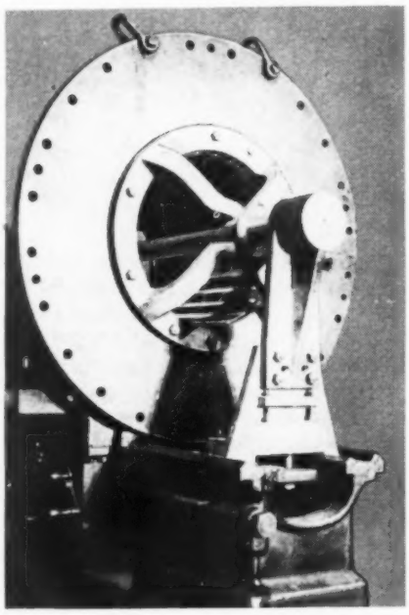
A 24-in. lathe was equipped for the job in this manner:

1. Two brackets were made to support the long boring bar (over 6 ft.) One of these brackets screws to the top of the headstock, and the other fits the ways as a tailstock. The latter is made in two parts and adjustment screws are provided for bar alignment.
2. The backgear pinion is borrowed to drive the bar, and of course, the brackets were made with this in view.
3. End-bell spiders which serve as follower rests for the long bar are fitted to the bearing.
4. The carriage is built up with angle iron to adjust and hold the bearing.

The work is now performed successfully at about one-tenth the cost and at a great saving in down-time.



The clearance between the headstock and the tailstock is just enough to permit the bearing and carriage to slide past the tool.

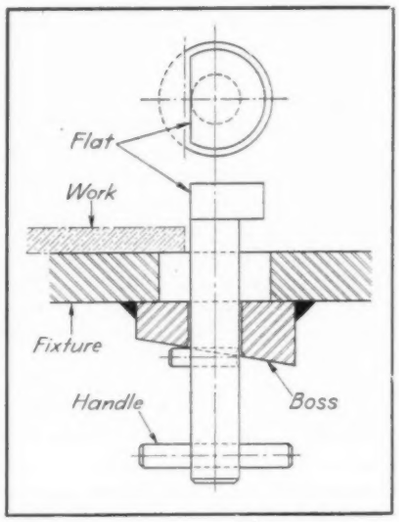


Tailstock end of lathe with the adjustable built-up tailstock in place. Note the two setscrews for aligning the boring bar. The boring bar revolves in a complete bearing rather than on a dead center

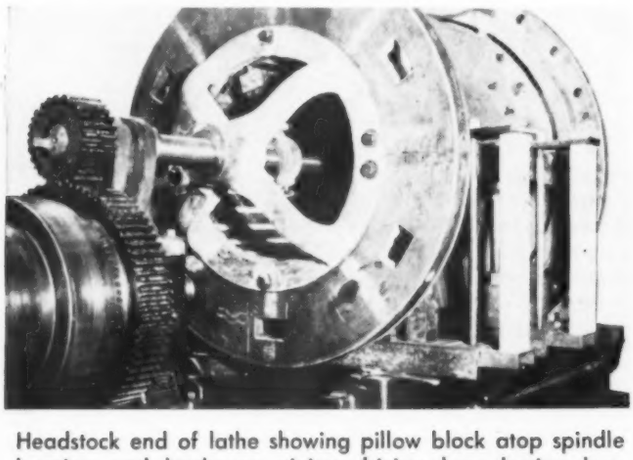
Wedge Type Clamp Disappears When Not in Use

AARON F. SCOBLIC
Chief Tool Designer, The Heil Co.

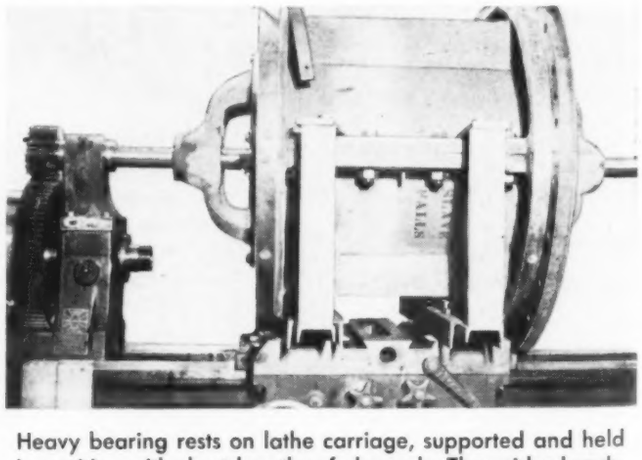
This clamp has recently been applied to a welding fixture with very satisfactory results. It was necessary to clamp a round flange between two brackets and then weld a piece of tubing in the center. The finished job had to be slipped out at one end between the brackets. Several of these clamps were applied to this fixture, on the sides and bottom, and because they were able to fit flush in the recess when not in use, the fixture design was greatly simplified. In some cases, a spring may be desirable to hold the clamp normally up or down.



Compact clamp operates from reverse of fixture and disappears into recess when not in use



Headstock end of lathe showing pillow block atop spindle bearing and backgear pinion driving long boring bar. Toolholder and bit shows just inside spider



Heavy bearing rests on lathe carriage, supported and held in position with short lengths of channels. The spider brackets on each end act as follow rests for the long boring bar

Machine Tool Electrical Standards—I

THESE STANDARDS HAVE BEEN APPROVED BY THE NATIONAL MACHINE TOOL BUILDERS ASSOCIATION

FOREWORD

These revised standards apply to machine tools coming within the following classification:

"Power driven, complete metal-working machines not portable by hand having one or more tool and work holding devices, used progressively removing metal in the form of chips."

Rapid technological advances combined with the experience of users and builders since the Machine Tool Electrical Standards C-74-1942 were approved June 8, 1942, have made it desirable to revise the Standards adopted at that time. This revision is the result of joint conferences of the Electrical Committee of the National Machine Tool Builders' Association and representatives of large users of machine tools, primarily those of the automotive industry.

The provisions of these standards are divided into these classifications:

1. (a) Minimum requirements for satisfactory electrification of machine tools for general industry use, in which the words "shall" or "must" are used.

(b) Good practice and which should be incorporated into future machine designs, and into present designs where practicable, as embodied in subparagraphs designated as "Recommended Practice" or following the word "should."

2. Provisions peculiar to the automotive industry, and designated under paragraphs headed "Automotive Standard."

It is recommended that purchasers of machine tools, in requesting quotation and in ordering, specify the type of electrical installation required in accordance with the above classifications. For example:

1. "The electrical installation shall be in accordance with Machine Tool Electrical Standards as revised June 29, 1945, for general industry use." or:

2. "The electrical installation shall be in accordance with Machine Tool Electrical Standards as revised June 29, 1945, for automotive use."

Any exceptions to either of the above should refer to the applicable paragraph number in the standards, with the exceptions clearly defined.

The machine tool builder should indicate in the quotation the type of electrical installation which is proposed, referring to all exceptions by appropriate paragraph numbers, and clearly describing the proposed electrical construction.

0. GENERAL

0.1 The purpose of these standards is to provide detailed specifications for the application of electrical equipment to machine tools which will promote safety of personnel, uninterrupted production and long life of the machine.

0.2 These standards provide for two types of electrical installations, as follows: The standard for machine tool applications in general industry; and the Automotive Standard which modifies the foregoing to suit the needs of the automobile industry.

Paragraphs applying only to the Automotive Standard are so marked, and may be referred to by paragraph numbers, as all paragraphs are individually and consecutively numbered. Where no Automotive Standard appears, the paragraph applies to both types of installation referred to above.

0.3 The purchaser will specify such additional details as are required to meet his local requirements, such as motor and control desired, electrical characteristics available, and provisions for unusual conditions.

0.4 When requested, the machine tool builder shall submit complete specifications for purchaser's approval. This shall be done when the machine engineering is completed. In such cases, final approved specifications shall be sent to the purchaser before the machine is shipped.

0.5 A nameplate listing voltage, phase and frequency, control circuit voltage and wiring diagram number shall be attached to the control equipment or machine.

0.6 On any point for which specific provisions are not made in these specifications, the provisions of the National Electrical Code (C-1-1940), or the latest revision thereof approved by the American Standards Association shall be observed.

1.0—DIAGRAMS

1.1.1 On machines having only one motor and one starter, the controller wiring diagram normally furnished with the starting equipment shall be considered satisfactory, provided the diagram shows all of the electrical equipment on the machine.

1.1.2 Where more than one motor, starter or auxiliary device is used (if the motors and controls are not entirely independent) a special diagram shall be furnished, making use of standard symbols and showing all of the electrical connections, including the numbers used on the wires or terminals. A copy of each diagram must be firmly attached to the inside of the covers of electrical inclosures either by adhesive material or by permanent data pocket or clip.

1.1.3 All special diagrams shall be marked with the serial number of the machine, or if none, with some other symbol which will identify the particular machine to which the diagram applies.

Three (3) copies of special diagrams must be forwarded to the purchaser by mail not later than the date on which the machine is shipped. These copies shall be identified with the purchaser's order number.

1.2—Elementary Diagram

1.2.1 When more than one starter or auxiliary device is used (if the starters or auxiliary devices are not entirely independent), an elementary diagram shall be included in addition to the controller wiring diagram. When requested by the purchaser or deemed necessary by the machine tool builder, a description of the sequence of operations shall be furnished. A schematic sequence of machine operations shall be shown when it is related to the electrical equipment.

1.3—Standard Symbols

1.3.1 Wiring diagrams shall employ symbols according to the American Standard Graphical Symbols for Power and Control, Z32.3-1945, except that electronic tube symbols shall conform to Graphical Symbols for Electronic Devices, Z32.10-1944 or latest revisions.

1.4—Conduit Layout

1.4.1 On large machines requiring a special foundation, the size, purpose and location of conduit and incoming lines that must be installed by the purchaser shall be shown on the foundation plan.

2. CONTROL

2.1—General Standards

2.1.1 Control devices, whether purchased or manufactured by the machine tool builder, shall meet the minimum requirements of the latest revisions of ASA Standard C-19.1-1943 and NEMA Standard 40-59 for Industrial Control Apparatus.

Note: Precision and other small devices used for control shall conform to accepted standards for that class of devices.

2.1.2—Automotive Standard (in addition to 2.1.1.)—No starter smaller than size 1 shall be used on any motor.

2.2—Disconnect Switch

2.2.1 The machine tool builder shall furnish and mount a NEMA type A manually operated, non-fusible, inclosed disconnect switch or a circuit breaker that will disconnect all lines of all power circuits to a machine at one point. Such disconnect switch or circuit breaker shall be arranged so that it may be locked in "off" position. When requested by the purchaser, the machine tool builder shall furnish a fusible NEMA Type A disconnect switch or circuit breaker of the specified type. This paragraph does not apply to small bench-type machine tools powered by a single motor rated 2 hp. or less.

Recommended Practice: Where practicable, the disconnect switch or circuit breaker should be made a part of the control panel and mechanically or electrically interlocked, or both, with the control inclosure door.

2.3—Protection

2.3.1 Motor running overcurrent protection shall be provided for each motor except in the case of short-time rated motors. For such motors, motor running overcurrent protection may be omitted when protected against overcurrent in accordance with Section 4323 of the National Electrical Code C-1-1940, or the latest revision approved by the American Standards Association.

2.3.2 Under-voltage protection shall be provided for all motors which might cause damage to the machine or injury to the operator should they start after interruption and return to power.

2.3.3 Where there is more than one motor on any machine and where possible damage may be caused by the stopping of any one motor, circuits

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Machine Tool Electrical Standards—II

shall be connected so that the opening of protective devices will stop all motors. Where the starting of motors in improper sequence can result in damage, interlocking to insure the proper sequence starting of such motors shall be used.

2.4—Motor Branch-Circuit Overcurrent Protection

2.4.1 *One Branch Circuit.* The conductors supplying all motors on a single machine tool may be considered a single branch circuit, which must comply with the provisions for motor branch circuits in Article 430 of the N.E. Code except as modified in the latest edition of Article 670 of the N.E. Code as follows:

2.4.2 *Several Motors on One Branch Circuit.* Controllers and running overcurrent protective devices for two or more motors connected to the branch circuit of a single machine tool need not comply with Section 4343 of the N.E. Code if all of the following provisions are complied with:

(a) *Motor Running Protection.* Each motor is protected by a motor running overcurrent protective device.

(b) *Rating of Overcurrent Protection.* The branch circuit has overcurrent protection of a rating equal to that specified in Section 4342 of the N.E. Code (C-1-1940 or the latest revision thereof) for the largest motor connected to the circuit, plus an amount equal to the sum of the full load current ratings of the other motors on the machine tool connnected to the same circuit, but in no case larger than 200 amp. at 250 volts or less; or 100 amp. at 600 volts or less, or as revised in the latest revision of N.E. Code.

(c) *Inclosure.* The control equipment and running protective devices are mounted in inclosures complying in all respects with the provisions of 2.5.2, 2.5.3, 2.5.5 and 2.5.7 of these standards.

(d) *Conductors.* The conductors of the branch circuit comply with the provisions of paragraph (b) of Section 4343 of the N.E. Code (C-1-1940 or the latest revision thereof).

2.4.3 Where line voltage is used for control circuits, if longest conductor from one side of the control line to the other side is not over 50 ft., and the control wires have a current-carrying capacity of at least one-third of the conductor from which they are supplied or if the branch circuit protective device is rated at not more than five times the current carrying capacity of the control wires, control fuses need not be furnished. (See also section 4372, National Electrical Code, C-1-1940, or the latest revision thereof approved by the American tSandards Association).

2.5—Control Inclosures

2.5.1 For the purpose of these Standards the word "inclosure" means the metal housing for the control apparatus, whether such housing be a part of the machine or separately mounted. A "compartment" is a space within the base, frame or column of the machine tool. The words "multiple number of control devices" or "multiple device control panel" mean special-purpose control designed specially for the machine, and do not apply to general-purpose control.

2.5.2 Control shall be inclosed and shall be mounted in such a manner and position as to guard it against oil, coolant, dirt and dust. If the control is mounted in the base or column of the machine, it shall be readily accessible; it shall not be considered inclosed if the space in which it is mounted is open to the floor, the foundation upon which the machine rests, or to other compartments of the machine which are not clean and dry.

2.5.3 Inclosures holding a multiple number of control devices shall be semi-dust-tight (NEMA Type or 1A equal) except for resistor, electronic tube, or transformer inclosures requiring ventilation. There shall be no unfilled holes in the inclosure for mounting the inclosure or mounting controls within the inclosure.

Such inclosures, containing starters for more than one motor and requiring branch circuit protection in accordance with paragraph 2.4.1 and 2.4.2, shall have a vent of 2 sq. in. or more in area to allow the escape of gases to a clean compartment of the machine of at least half the volume, and a ½ in. drainage hole shall be provided at the bottom of the control compartment. The walls or doors of such inclosures shall be not less than No. 14 USS gage if of sheet steel, not less than ⅛ in. if of cast metal, or not less than 3/32 in. if of malleable iron.

Recommended Practice: All control devices for any one machine should be mounted in one inclosure instead of in several inclosures at different locations on the machine.

2.5.4—Automotive Standard

Instead of 2.5.3.—Semi-dust-tight inclosures (NEMA type 1A or equal) shall be used except inclosures housing rheostats, resistors or other heat-generating control which would be definitely damaging to the equipment if the compartment were not vented. Doors and other parts of machine compartment for built-in control shall be sheet steel not less than 14 USS gage, or cast metal not less than ¼ in. thick, or malleable iron not less than ⅛ in. thick. There shall be no holes in the inclosure for mounting the inclosure, or mounting controls within the inclosure. Machine compartment for built-in control shall be completely isolated from coolant and oil reservoirs and shall be located to provide protection from coolant, oil, chips and dirt. There shall be no openings of any kind between control compartments and reservoirs holding coolant or lubricating or hydraulic oils. All control devices for any one machine should be mounted in one inclosure instead of several inclosures at different locations.

2.5.5 All control inclosures for a multiple number of control devices, either separate or integral with the machine, shall have hinged covers which swing horizontally and with adequate means for fastening in closed position.

2.5.6—Automotive Standard (replaces 2.5.5) All control inclosures for a multiple number of control devices, either separate or integral with the machine, shall have hinged covers which swing horizontally and shall be held closed with screws or bolts which require the use of a tool, such as screw driver or wrench, to remove. Doors on inclosing compartments shall have suitable gaskets (metal-to-metal contact will not be considered equivalent).

2.5.7 Inclosures for mounting control shall provide ample room between panel and case for proper maintenance and electrical clearance. Barriers between arcing parts of control must be of insulating material which will not readily carbonize.

Exposed non-arcing current-carrying parts within the inclosure shall have an air space between them and the uninsulated walls of the enclosure, including the conduit fittings, of at least ½ in. for 600 volts or less.

2.5.8 Mechanical adjusting means not associated with electrical equipment shall not be provided in the same inclosure with motors or controls.

2.6—Mounting

2.6.1 Control shall be mounted so as to minimize the possibility of damage from floor trucks or other moving equipment. It shall be protected against falling or splashing liquids. Minimum distance from bottom of panel to floor, and height and width of door opening, shall be adequate for servicing. Panel shall not be set to such depth from door frame or other projecting portion of machine as to interfere with inspection and servicing.

Recommended Practice: Electrical equipment should be kept above the base line of the machine as much as practicable and made as accessible as possible. The following recommendations are included as minimum specifications for best accessibility and should be exceeded insofar as practicable:

All terminals and parts of devices normally serviced or inspected on control equipment should be mounted not less than 8 in. above the floor line of the machine. The width and height of the panel should be at least 1 in. less than the corresponding width and height of the door opening. The depth of the control compartment should be a minimum consistent with the maximum depth of the control device plus the required electrical clearances. No portion of the machine immediately above the door opening and less than 6 ft. from the floor should project more than 6 in. beyond the door frame.

2.6.2—Automotive Standard (in addition to 2.6.1 and instead of above "Recommended Practice"). When inclosure is mounted on the machine, the bottom of inclosure shall be 2 ft. or more above the floor. When separately mounted the purchaser will mount inclosure at desired height.

2.6.3 Control shall not be mounted in a position that will interfere with machine adjustments or maintenance of hydraulic or mechanical equipment, or vice versa.

2.6.4 All control equipment, such as limit switches, brakes, solenoids, and push-button stations, shall be mounted in a rigid, readily accessible manner in a reasonably dry and clean location free from possibility of accidental operation by normal movement of machine or operator, protected so that it cannot be operated by accident, and with enough clearance from surrounding surfaces as to make removal and replacement easily possible.

(To be continued)

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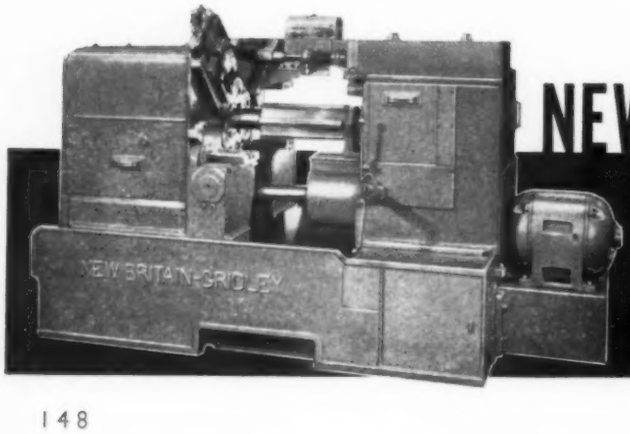

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NEWS OF METALWORKING

Aircraft Standby Plants

Ten aircraft and four aircraft engine plants have been placed in standby status by Army and Navy according to Surplus Property Administration's report to Congress. They are: Bell, Marietta, Ga.; Boeing, Wichita, Kan.; Consolidated Vultee, Ft. Worth; Curtiss-Wright, Columbus; Curtiss-Wright, Louisville, Mo.; Douglas, Tulsa; Martin, Omaha; North American, Dallas; North American, Kansas City. Engine plants: Allison, Indianapolis; Pratt & Whitney, Kansas City; Studebaker, South Bend; Wright Aeronautical, Lockland, Ohio. These plants cannot be sold, but can be leased for production that will not require much change in layout and facilities.

German Scientists Coming

The Army is bringing about 50 German scientists to the U. S. to aid in development of rocket, turbojet, and gas turbine design—in which the Germans excelled. The scientists will serve voluntarily and for pay, and are glad to do so since all opportunity for them in Germany has vanished. Some of the 50 being brought here are Nazis, which may result in difficulties with American scientists and public condemnation of the move.

Atomic Claims Settled

Persons who think atomic processes are something new in the world should note that the U. S. Army is now engaged in settling claims of inventors who held patents on features used in the manufacture of atomic bombs.

Chicago Dodge Plant

The government-owned Chicago Dodge plant may be leased by a syndicate, headed by Preston Tucker, racing car designer, and financed by a group of West Coast airplane manufacturers. The group is reported to be planning the manufacture of a rear-engine auto. Further sale of equipment from the plant, in the meantime, has been stopped.

Surplus Steel Oversold

The steel shortage, heightened by the strike, caused a rush of buyers to R.F.C. district offices, seeking all types of surplus steel. The result was that many items were simultaneously sold to several buyers, and a large number of cancellations had to be issued on the grounds that the analysis of the surplus steel sold was not that asked by buyers.

French Recovery Bottlenecked

Transportation, power and labor constitute the three chief bottlenecks in French industrial recovery. French industries are now operating under 45% of prewar level—steel is at 30%. Coal production is only a fraction of prewar level, despite working of prisoners in mines and a 48-hour workweek. Dry weather last year cut into the hydroelectric power available (it comprises 65% of France's total power). French have plans afoot for using 1,000,000 Germans as laborers, and are now trying to acquire surplus U. S. war and industrial equipment in Europe.

Fog Dispelling System

Nofog Corp., Long Beach, Cal., recently demonstrated an airport fog dispelling system that may prove practical. The Nofog demonstration used six open burner tubs, burning 1500 lbs. of coal and $5 worth of calcium chloride in a night's run. Theory is that heat carries up carbon particles coated with calcium chloride, which draws moisture. A ceiling of 200 ft. and 2500 ft. visibility were obtained in a heavy fog.

IN BRIEF

PITTSBURGH—Steel consumers appreciate that they will require price increases to offset pending higher steel prices and CIO wage demands, but they fear that OPA will be slow to act on their problems. Some steel executives believe that further mechanization of the industry is necessary to offset higher labor costs. (See page 148e.)

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NEW YORK—The labor management crisis is being resolved into a price crisis. The Ford and Chrysler settlements point to generally higher wages granted by strike-bound plants, but industry seeks assurance on price adjustments necessary to offset all, or at least some, of the increased labor cost. (See page 148h.)

• • •

LONDON—The British government and industry are aggressively pushing foreign trade, even though export volume will be restricted until mid-1946. British auto industry laying long-range expansion plans. (See page 148f.)

• • •

CLEVELAND—Tool builders are being tied up by lack of motors, as a result of the strike in the electrical manufacturing industry. Some builders are holding up shipment of units to strike-bound plants on the instructions of their customers. Inquiry volume is still high. (See page 148c.)

• • •

LOS ANGELES—Coast metalworking plants fear they may be unable to meet competition from midwestern and eastern plants after the present wave of wage and price increases have settled. High material costs and already high wage rates militate against substantial further pay boosts. (See page 148d.)

Gaging Business

Price Crisis Now Looms

The inevitable outcome of the national labor crisis has been acknowledged finally by government officials, and industry generally faces higher prices to compensate, fully or in part, for higher wages supported by the government. However, industries affected indirectly by current strikes fear that OPA may delay decisions on price relief to users of steel, electrical products, and other items probably slated for price boosts to offset wage increases. Such delay may throw many segments of industry into confusion unless a new wage-price formula is devised by government officials.

Once the steel strike has been settled, along with the General Motors and the electrical manufacturing industry tie-ups, business can look forward to some sporadic jurisdictional battles between the A. F. L. and the C. I. O. Such strikes may particularly hamper the metalworking industry. Aside from that, the major uncertainty will be the coal industry, which will resume wage negotiations with John L. Lewis in the near future.

Strike Effects Lasting

The 3,000,000 tons of ingot steel that have been lost, the thousands of auto parts and electrical motors that have not been produced during the strike, have set back the metalworking industries anywhere from two weeks to probably a month from previous production schedules. It will take time to refill the pipeline of supplies—steel, equipment, and semi-finished products—that industry requires to maintain specific production schedules. Lay-offs have already occurred as many plants have had to shut down part or all of their operations due to materials shortages.

The electrical strikes have held up deliveries of completed machine tools, for example, due to a lack of motors. Already swamped with orders, motor manufacturers will be in a worse predicament when they resume operations. Some tool builders have shipped units minus the motors, with the promise of delivery of the motors as soon as possible. Several tool builders' plants were tied up by the steel strike, since their workers were affiliated with the CIO-USWA.

Tool Business Steady

Despite the increasing inroads of surplus sales, tool builders continue to report a favorable volume of inquiries and new business. Some buyers, unable to secure prompt handling of inquiries to surplus offices, have decided to wait for lengthy delivery of new machines instead. Meanwhile, various machine tools badly needed by manufacturers of consumer goods remain inaccessible in government surplus inventories. Some surplus tools have not yet been properly listed and data on them is lacking at surplus disposal offices, while the difficulties of organization of some RFC district offices is hampering effective handling of potential buyers. This situation limits the effectiveness of machinery dealers who recently signed up to help sell government surplus items on a commission basis.

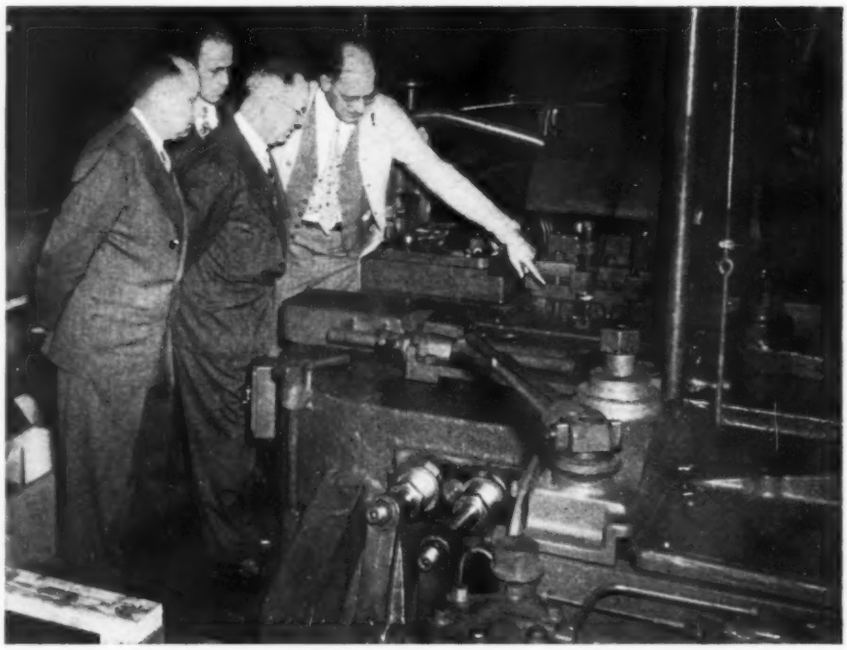
Business in portable tools is excellent. One of the country's largest makers reports that its production today is running several times the peak war volume and its incoming orders are double its current production rate. The task of filling jobbers' and users' stocks is partly responsible for this extraordinary situation. Some 25-30% of this business is originating from abroad. The management expects very good business throughout 1946, but it is facing a shutdown, unless the steel strike is settled soon.

Peacetime Production Score

Production of peacetime goods dipped in January from the December level, which had paralleled the November output (November was the first month that had registered a gain since the war's end). Surprisingly, the recent progress shown in peacetime production was more favorable in capital goods than in consumer goods. The January production decline was not only attributed to strikes, but also to: (1) a continued attitude of laxity and indifference toward jobs by labor; (2) inability of many manufacturers to make certain items at a profit under existing OPA price ceilings; and (3) reluctance of buyers generally to make firm future commitments so long as labor and price uncertainties remain.

WAC OFFICIALS APPOINTED

WASHINGTON—In addition to Lt. Gen. Edmund B. Gregory, who recently assumed his duties as chairman of War Assets Corp., several other administrative officers have been appointed, including: Sterling J. Foster as vice president in charge of producers and capital goods; Fred E. Berquist, vice president in charge of plant disposal; and Walter E. Joyce as assistant to the president in charge of liaison with SPA; and John C. Pyle, Jr. and James A. Garfield, assistant vice presidents in charge of aircraft and airports.



The New ¾-in. Boltmaker —National Screw and Manufacturing Co. executives view its new ¾-in. boltmaking machine. Entirely push-button operated, it has an electric control panel and can turn out a carload of finished bolts or capscrews every 24 hrs., using a ton of wire an hour. From left to right are: Harvey Erdman, technical assistant; C. F. Newpher, vice president; Walter Summerhill, engineer; and William Sutton, boltmaker foreman

Motor, Bearings Lack Cuts Machine Tool Output; Deliveries Uncertain

CLEVELAND — Depleted inventories of motors and the growing scarcity of bearings may result in a serious curtailment of production by leading tool builders in the near future. These factors loomed as greater handicaps than steel supply, which was adequate for about 30 days' operations. As it is, shipments of finished tools are already being held up due to lack of motors or bearings.

Machine tools scheduled for delivery through mid-February will for the most part have been shipped as promised, but manufacturers are making no delivery commitments beyond that date. Inability to make delivery promises due to the current labor situation has permitted some builders to turn away new business, and make some progress against heavy backlogs. Other tool builders are notifying customers that their orders will be filled on schedule, but that shipment will be made minus motors, which will be supplied as soon as available.

At the same time, tool builders are receiving "hold" orders from various customers whose plants are strike-bound. Thus, tools, crated and ready for shipment, are being held up at the builders' plants.

Many tool builders still look to optimistic operations and fair volumes of business, once current strikes are settled. Inquiries continue to increase, despite the growing competition from surplus equipment sales. But many purchasers seek the latest and best models, rather than looking for surplus bargains.

Surplus Delays Scored

Tool dealers, licensed by RFC to sell surplus machine tools, are beginning to get discouraged by the delay and red-tape facing them in their attempted dealings with surplus officials. It is reported that it takes the surplus office as much as four to eight weeks before some machines can be located. Even then, if the customer employs over 500 men, he is forced to stand aside while small firms satisfy their requirements.

Although it is generally believed that surplus disposal employees are sincere in their efforts to be helpful, general disorganization of procedures and improperly trained personnel account for many of the difficulties encountered by prospective purchasers of surplus equipment.

Surplus Tool Subcommittee Makes Its Recommendations at SPA Meeting

WASHINGTON — The newly-formed Industry Advisory Committee for Metalworking Machinery, formed by the Surplus Property Administration, received suggestions for certain standardization of forms and better coordination of district surplus disposal offices from the subcommittee on surplus tool disposal at a meeting here on February 13th. The subcommittee had previously met in Cleveland on January 28th, and in Washington on January 15th, when it was initially formed.

Billions In Prospect

At its first meeting with surplus disposal officials, the committee was told that of $233,000,000 of surplus machine tools on hand as of Nov. 30, 1945, 27% consisted of lathes, 21% boring machines, 18% grinding machines, 18% milling machines, and smaller percentages of other tools. At that point, $81,000,000 worth had been sold, indicating total acquisitions of $304,000,000. SPA expects to acquire $1,400,000,000 more in surplus machines by July 1, 1947, and expects a total inventory of $1,600,000,000 by Nov. 30, 1947.

SPA spokesmen stated that they recognized criticism of delays in finding machines wanted by customers, mostly due to red tape, and that improvements are being made. They said, too, that they are trying to stop irregular transactions. Hope was expressed that some 3,000 agents would sign up to help distribute surplus equipment, under the dealer agreement.

It was explained to the committee that Army, Navy, and other federal agencies owning machine tools are authorized to sell them direct, without declaring them surplus, to contractors in possession. Over a period of four months, machines costing $40,000,000 had been sold directly to operators.

Surplus Interest High

The committee was told that a survey recently showed that 90% of over 2,000 plants intended to buy machine tools, and almost one out of three wanted government-owned tools. The establishment of machine tool advisory committees in all 31 of RFC's regional offices is contemplated.

The new Metalworking Machinery Industry Advisory Committee includes the following members: Robert Bierbaum, Eastern Machinery Co.; A. G. Bryant, vice-president, Cleereman Machine Tool Co., Chicago; A. B. Einig, general manager, Motch & Merryweather Machinery Co.; Harvey H. Goldman; William P. Kirk, vice-president, machinery department, Pratt & Whitney Division, Niles-Bement-Pond; Knowles Pittman, assistant to president, Clearing Machine Corp.; Frank Reed, vice-president, Niagara Machine & Tool Works; Charles A. Simmons, Sr., president, Simmons Machine Tool Corp.; Robert L. Giebel, Giebel Machine Tool Co.; James Y. Scott, president, Van Norman Co.

Surplus Tool Office Swamped By New Inquiries, Green Help

NEW YORK—The mushrooming of the RFC surplus disposal office here over the past four months is believed to be responsible for the present indicated confusion and lack of coordination now attending the operations of the surplus machine tool section. Located in terribly crowded quarters and staffed with "green" civil service help for the most part, the office was apparently unprepared to handle inquires from tool dealers as fast as they were signed up to help with surplus tool disposal.

Tool dealers complained that they were being told that they would have to get on the "waiting list" for various types of tools, but inquiry at the RFC office disclosed the non-existence of such "waiting lists." Complaints from tool dealers that no attempt was being made in several cases to locate machine tools in other areas were explained by the fact that some new help was handling phone calls during the first day they were hired.

Surplus Declarations Poor

RFC officials explained that some surplus declarations in past months were so badly botched up by the services, that physical checks of the items listed had to be made to obtain necessary data on age, and make of machines, and so on. This explains why the New York district office has not issued a tabulation of surplus machine tools since last summer. Meanwhile, those interested can get on the special mailing lists for notification of available equipment from other district offices.

WAA TAKES OVER WAC, SPA

WASHINGTON — War Assets Corp., newly formed subsidiary of RFC, and the Surplus Property Administration have been merged into a new War Assets Administration, to be set up as an independent agency on March 25. The new agency will both set surplus policy on capital and consumer goods and carrying out such policies. Lt. Gen. E. B. Gregory will head WAA.

West Coast Metal Plants Concerned Over Effects of Higher Wages on Prices

LOS ANGELES—Southern California metalworking plants, with the exception of job shops momentarily busy on equipment orders from line production plants, are still virtually marking time, production-wise, and "sweating out" the current wage-price battle centered in Washington, D. C. They realize they will "pay through the nose" if the decision fails to make provisions for their "innocent bystander" status.

Already handicapped by high transportation costs on materials coming West, and finished products going East; production efficiency that is down 20 to 40 percent from its own pre-war levels; and wage scales 5 to 30 percent higher than prevail in other areas, metalworking plants here are worried over the apparent trend current wage-price negotiations are taking.

Regional Differentials

If settlements finally agreed upon in Washington call for flat increases in wages and prices, without regard to regional variations, the California plants will have to continue cautiously on plans for the future.

Typical of management's alarm, was the public analysis and warning issued by the Metal Trade Manufacturers Association, through its manager, Eltinge T. Brown. The statement pointed out that Los Angeles wage rates are above average for the United States, and any increase in present labor costs "by even 1%" might put Los Angeles out of competition with the rest of the United States on iron and steel castings, and probably many other metal products. He added that steel and iron castings are now being made in the East and delivered to Los Angeles at much lower prices than they could be made locally.

Coast Wages Higher

The Los Angeles-San Francisco area has the third highest average hourly earnings for steel and iron foundries, and is only topped by Detroit and Seattle. For specific examples, the average rate for coremakers in the Los Angeles-San Francisco area is $1.29, as against the Eastern rates ranging from $1.03 to $1.20 per hour.

The statement declared that castings made in the East and Midwest are being shipped to Los Angeles for 2¼-2½c-per-lb. less (after freight charges) than they can be made locally. Many finished parts are also being shipped in at similar relationships.

In spite of their worries over wages, costs and prices, metalworking plants are finding time to also worry over materials. Steel, naturally, causes concern and may slow up or actually close up some production, small as it is. But steel is not the only bottleneck. Aluminum extrusions are also reported on the hard-to-get list. And such items as radio equipment, bearings and brains are still on the short side.

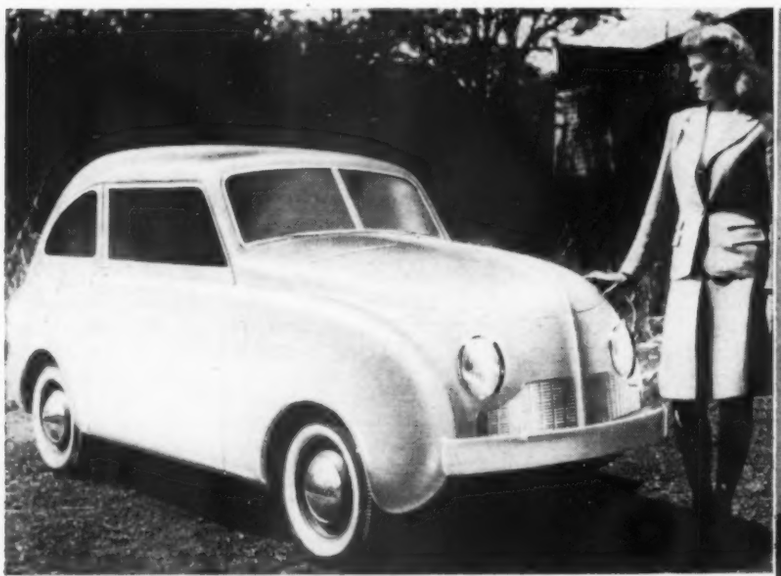
Brains Shortage, Too

The brains shortage, according to one typical company president, is principally in the production engineering field. His plant is impatient to get going, but has to trudge along because of its inability to get enough production engineers to translate its new, experimentally proven products into production designs.

Another plant, making construction contractor's equipment, reports its customers putting on the pressure, because of increasing new contract lettings, but deliveries are being slowed by lack of wheel bearings, and now a looming shortage of steel. With current orders sufficient for 90 days of capacity production, steel on hand will last only 30 days.

Vets Lift Efficiency

Returning veterans, last month reported showing their greater skill by upping the efficiency curve slightly over its wartime averages, are adding another bit of encouragement. The accident rate is going down, and the drop is attributed to the greater know-how and safety skill of returning veterans.



Highlights of New Crosley Car—Powel Crosley, Jr., president, Crosley Motors, Inc., holds the 58-lb. Taylor engine (26½-hp) at right for the new Crosley. Made of sheet steel stampings, the unit fits into the four-passenger aluminum body shown above. The etched satin finish protected by a coating of lacquer, gives the car an aircraft appearance. Its overall height is 57 inches, overall width is 49 inches, and its length is 145 inches from bumper to bumper. The car is said to go 50 miles on a gallon of ordinary gasoline.

Detroit Letter

Steel Strike Key

Just as it lead the nation into the greatest industrial strife of all time, so may the automobile industry lead it back into the path of industrial peace. Two of the Big Three have already cracked the nation-wide deadlock on wages, giving unprecedented increases to its workers. The third, GM, may be in the fold any day.

But none of the gains made by the automobile industry will mean anything unless and until steel settles its troubles. Even while granting its more than 100,000 workers an 18-cent wage boost, Ford was preparing to shut down its production lines all over the nation. The pay increase appeared small compensation for loss of steady earnings.

Now as never before, it appeared up to the steel industry to decide which way the nation was to go. The automobile industry could make peace with its tiniest member but could not bring cars off the assembly lines without parts or materials.

Ford, Chrysler Pacts Sudden

Both the Ford and Chrysler wage pacts came with astounding suddenness. Chrysler had been without a union contract since December 4, when the old one expired. Bitterness was almost as rife as with the General Motors dispute. After extending the old contract twice, Chrysler finally declared it at an end.

But just the day before the agreement was reached, January 26, rumors began to fly. A hint came out of Washington that both sides had agreed to an 18½-cent increase, only a cent under what the fact-finding board had recommended for GM.

On the same day, Ford and the UAW negotiators had bogged down again. The next meeting was indefinite. Then came the rumor of Chrysler preparing to sign up at any moment.

Ford Won Race

Immediately John Bugas, ex-G-man head of Ford labor relations, sprang into action. He called Dick Leonard, UAW's negotiating chief and arranged a hurried meeting.

By a matter of a few hours, the Ford Co. won the race for being first to make peace. Just two hours later Chrysler announced its agreement. There was just one-half cent difference in the increases, Ford giving the union 18 cents on top of its average of $1.21 an hour, while Chrysler gave the rumored 18½-cents to its average of $1.14.

Chrysler scored the greater victory because it had a complete new contract. Details of the Ford raise were still to be worked out.

Increases Set Record

The Chrysler contract affects 50,000 workers of the 65,000 on its pay rolls. The wages of the 15,000 others will be adjusted later.

The increases were the highest offered by any industrial firm since the CIO started its drive for 30 per cent. It also put GM in the position of seeing its two greatest rivals get in step for the time when full production can get under way.

Action for GM was not long in coming. The ink was hardly dry on the two agreements when Jim Dewey, former ace Federal conciliator, blew into Detroit. In the next 48 hours he was all over town, meeting first with C. E. Wilson, president of GM, and then with the union officials.

Meanwhile the National Labor Relations Board opened a hearing on charges that GM had failed to bargain properly with the union.

Maurice Sugar, chief counsel for the UAW, demanded back wages for all GM strikers, contending that the corporation's failure to bargain fairly caused them the loss of earnings.

Output Still Disrupted

While the turn of events in the industry heartened onlookers, other troubles beset the industry. Those still producing some cars began to lay off.

The Chrysler divisions, just through with sampling their dealers on 1946 models, were also set to fold. Glass had held them pinned down before. Now it was steel, principally bumpers.

The parts manufacturers announced they were in bad shape and could not go long on present steel supplies.

Higher Prices, Wages to Disrupt Steel Industry; More Mechanization Likely

PITTSBURGH — Although specific planning on the part of steel consumers and steel producers was severely disrupted by the strike, the rough outline of what must be done after labor peace is restored is already shaping up. The problems ahead indicate chaotic conditions.

Thus, while it appeared incongruous to accept new steel orders while the mills were down, and large backlogs prevailed, sales officials of steel companies were inclined in the main to permit additional orders to be filled in district offices. Consumers, interpreting their own needs and desires, were asking revisions in specifications requiring a shifting of tonnage to other periods. Cancellations were the exception rather than the rule as users endeavored to hold on to the tonnage which they had ordered.

Fabricators Squeezed

The problems of the fabricators and other processors tended to grow as the strike was prolonged. They saw themselves the victims of a double increase in costs with the probabilities of both a price increase and a wage increase. To the extent that their own products are subject to price regulation, they saw the immediate need of relief from the OPA but were placed in the anomalous position of being unable to apply for such relief until it became known what the price increase would be. They had a more or less good idea of what the wage increase would be and they wondered how much time would elapse between the period when their costs would jump and they could raise their own prices. Some fabricators, it must be pointed out, were quoting during the period of the strike on a basis of the probable higher costs when they were figuring jobs outside of the jurisdiction of the OPA.

Inventories May Help

The saving grace in connection with high cost-low selling price gap for these interests is the extent of their inventories of steel. Neither they nor other types of consumers of the steel mills are adding anything of importance to their inventories during the period of the strike despite the fact that 5 per cent of the ingot capacity of the nation was undisturbed.

One of the results of the strike with its higher ratio of costs to gross will be an increased endeavor on the part of management to find new economies through mechanization. This is also being forced from the consumers' end through demand for better finishes. It is the consensus of a number of steel engineers that the industry still has possibilities in respect to greater mechanization. These authorities say, for instance, that there is more avenue for accomplishment along this line in steel than in the automobile industry. They say the motor trade industry has about reached the ultimate in mechanization.

London Letter

Reconversion Slowed

Britain has little to show in terms of production for her reconversion program. Contributing causes are: (a) Concentration on exports by industries easily converted; (b) Lack of raw materials; (c) Slow retooling in plants requiring 100% reconversion; (d) A paradoxical labor shortage; and (e) Continued government controls. Despite such difficulties, peak output for export is expected by the end of 1946, with added production following in 1947 to satisfy home markets. There is little concern that the Socialist government's nationalization program is hampering reconversion.

Retooling is slowed because machine tool builders and makers of other equipment are exporting at least 50% of their output. The remainder is insufficient to meet either their own modernization plans or retooling programs in reconverting plants. The number of such plants is exceptionally high in comparison to the situation in the United States.

Automotive Industry Plans

Although proceeding immediately to build some postwar models, the British motor car industry is planning for increased output in two or three years. They will need three years to modernize designs, retool factories, and manufacture on a mass-production basis, while they analyze sales appeal of British design versus American types. Indications are that the British car will still be smaller than American types, but there will be increased space for passengers on a given wheel-base. Sales appeal will be based on so-called "smooth lining" as opposed to what the British consider extravagant American streamlining. Such cars are expected to sell for $800.

All motor car makers will modernize plants for quantity production. To accomplish this, they will need specialized machinery and equipment from the United States if their cars are to compete in style and quality with American types. Specialized machine tools for the automotive industry, large presses, and flash-welding equipment will be needed in quantity for efficient fabrication of steel bodies. Gear-cutting machines will also be in heavy demand. And the British will find the necessary dollar exchange for purchasing such tools.

Plant efficiency will be increased, since it is imperative to permit the export of 50% more cars than prewar. In 1935, the British motor car industry employed 165,000 workers and produced nearly 400,000 motor vehicles of all types, while the U. S. produced nearly 4,000,000 vehicles with 450,000 workers. Average weekly hours worked in Britain and the U. S. were 48 and 37, respectively. Thus, with only twice as many man-hours, American industry produced nearly ten times as many cars as Britain.

The U. S. exported annually more than 3½ times as many cars as Britain, even though 81% of British exports went to Empire countries. American exports to countries outside the Empire exceeded the British by 12-to-1.

Auto Exports To Increase

Between VE-Day and December 1, the five major manufacturers built 6,812 cars. Production in 1946 is expected to reach 470,000 cars, 135,000 trucks, and 120,000 buses, with 50% of each destined for export. In 1938, the British exported 68,000 cars.

The cost of all British industry, and British exports, hinge critically on steel price policy. In 1938, the cost of finished steel here averaged 40% greater than steel furnished to American consumers by U. S. mills. During the war, cost increased about 36%. A new schedule of steel prices for 1946 has just been issued with an over-all increase of 5%. As a result, there is a hue-and-cry for the British steel industry to modernize its plants and sell steel at prices that will lower cost of finished products.

Exports All-important

British workmen and British industry are accepting the stringent conditions that will face the nation internally for several years, as export volume is expanded as much as possible. While industry reconverts and modernizes, foreign trade experts are promoting overseas sales of British goods, some still on the drawing boards. Thus, even though Britain cannot compete very aggressively with U. S. output for export during the first half of 1946, her sales organization is already functioning.

The Foreign Office plans to send trained representatives abroad, who will be aided by the Consular Service. Permanent export representatives will be appointed in all major regions. Moreover, the Board of Trade is fostering personal contact between exporters and buyers overseas. Priority travel and best accommodations are given to trade representatives, who are now leaving Britain at the rate of 1,600 monthly. Government commercial representatives abroad are being brought back for consultation. Special facilities are being given to foreign businessmen visiting.

European Trade Resumed

Private trade with Continental countries is again in full swing, and export licenses are no longer needed for machine tools, other plant equipment, tools and gages, hand tools, cars, trucks, and buses, Belgium, Holland, Luxemburg, Finland, Denmark, France, Czechoslovakia, are prepared to issue import licenses to private traders for the import of goods. Payment for goods can be made in both directions either in sterling or through currency of the importing country.

The French government is granting licenses for imports of spare parts and replacements for all types of machinery and equipment, as well as for manufactured products weighing less than five tons and worth less than $25,000. Licenses are being issued by Britain for importing from France those raw materials and articles that can be used in the manufacture of finished products intended for the British export trade.

EXPORT TARGETS FOR BRITISH INDUSTRY

(monthly averages in millions of $)

Products	1938	1944	1945	Monthly Export Target
Iron and Steel	13.0	2.8	6.4	20.0
Non-ferrous Metals	4.0	1.6	3.7	6.0
Cutlery, implements, hardware, instruments	3.0	2.4	3.0	4.5
Electrical goods and apparatus	4.4	4.0	4.4	6.5
Machinery	17.2	13.2	13.6	26.5
Textiles	30.0	20.0	28.0	45.0
Chemicals, drugs, dyes	7.2	8.2	12.0	15.0
Oils, fats and resins	1.6	0.4	0.9	2.4
Leather goods	1.2	0.4	0.46	2.0
Vehicles, including locomotives, ships, aircraft	14.8	4.0	5.2	22.0
Rubber products	0.4	0.1	0.24	0.8

Washington Bulletin

WAC Task Huge

Asked if he thought industry would begin to complain about competitive sales of surplus property as soon as reconversion is in full swing, General Edmund B. Gregory, chairman of War Assets Corporation, told a representative of *American Machinist*: "Certainly. No matter what we do there will be complaints." But, he added, that is not the main reason WAC is pushing surplus sales. The chief objective is to place the goods in the hands of manufacturers and consumers now, to promote production and employment. This is particularly true of machine tools.

General Gregory, Quartermaster General in command of Army supply since 1940, probably knows more about government property than any other man. Under his control, during 1946, will be $32 billion worth of surplus goods for sale. With him, as vice chairman of WAC, is Maj. Gen. Glen E. Edgerton, who handled surplus disposal for the War Department after World War I. In reply to talk that WAC is being "militarized," Gregory says he is not a "typical" soldier—is already seeking the advice of civilian leaders. Members of his staff point out, too, that though he is on loan from the Army, he is nearing retirement.

Inflation Support Gains

Pressure for higher prices to encourage production and pay higher wages is gaining here. Administration-approved wage increases, and steel prices, if authorized, will mark the definite breakdown of the price line policy the administration has contended it has been holding. Most leaders are convinced that a little inflation is the most palatable of all the bad medicines prescribed for the situation.

Official estimate of the Civilian Production Administration is that, taking World War I inflation as 200, we are now at the 140 mark, and can safely stand some more. Whatever increase is granted in the price of steel, together with increases in wages by big industries, will show up immediately on the national inflation meter.

On the other hand, some CPA officials contend that if the price line is held rigidly, many priorities will have to go back on to control distribution of products in reduced supply due to strikes and limited profit margins. Demands for reinstitution of priorities are rising.

Contract Settlements Lag

By June 30, 1946, less than 5% of the 168,000 unsettled war contracts pending on VJ-day will remain open. A major factor slowing settlement in the third quarter of 1945 was strikes. In some cases, the contractor's settlement personnel were not permitted to enter plants, and the problem is becoming increasingly serious. Interests of both labor and management are damaged by delay in contract settlement. It is reported that the rapid demobilization of service personnel has also contributed to the slowdown. Office of Contract Settlement urges war contractors to file claims more quickly and to give more attention to the work involved.

Materials Highlights

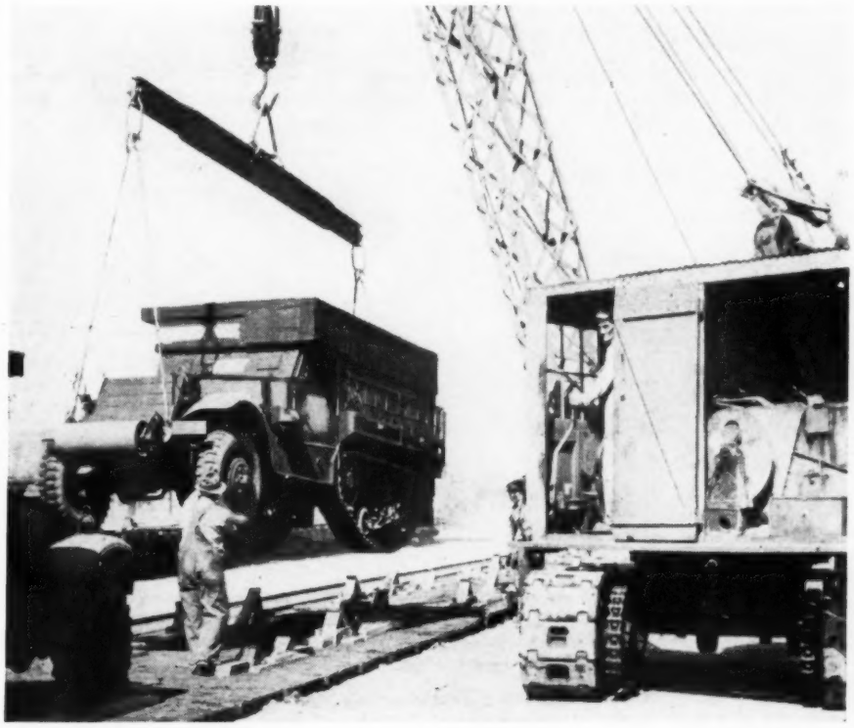
Interior Secretary Ickes is advocating stockpiling by the U. S. strategic metals available only by importation. He says the metals would strengthen the military position of this country; that we would be investing, not giving the money away; and that such purchases abroad would add to the dollars in foreign hands to trade with us.

Materials still scarce include nearly all building materials, sheet steel, nearly all castings, tin and rubber.

OCS Deputy Director

H. Chapman Rose

Now Deputy Director of Contract Settlement, Mr. Rose has been nominated to be Director. He has held various government offices in connection with contract settlement.



No Surplus Sales Here—War material, some never used, enters storage at the Army's Letterkenny Ordnance Depot, Chambersburg, Pa. These half tracks, being swung off flat cars, were ready for shipment overseas when the war ended

Passing Labor Crisis Becomes a Price Crisis; Washington Sets Scale

NEW YORK—Although nearly a million and a half industrial workers were idle in strikes throughout the nation as February got under way, only a small decline from a January strike crest of 1,650,000 workers, there was firm basis for more optimism over labor conditions than at any time in the three months of tension which began to break in the Ford Motor Co. and Chrysler Motors settlements with the C.I.O.'s United Auto Workers. Strikes in the steel industry, in electrical manufacturing, and in General Motors had signs of being in final stages. More significantly, what had started out as labor-management wage disputes were shaping into new form as industry-government pricing tests.

New Price-Wage Formula

No overall Washington-inspired formula had yet emerged for determining how much management must raise its payroll to insure industrial peace and an opportunity to produce for the waiting market. Settlements were coming through piece-meal, on a company-by-company, industry-by-industry basis. But all were falling into a pattern.

Major settlements which set the pattern were those at Ford, for 18c an hour, or slightly more than 15% in its basic wage; Chrysler, 18½c an hour, or 16.7%; the Radio Corp. of America, 17½c an hour; major oil refineries, 22½c to 25c an hour, or 18%; Henry J. Kaiser, for his Fontana, Calif., steel mill, 18½c an hour, and the Lockheed-Vega Aircraft Corp., Burbank, Calif., a straight across-the-board 18c an hour increase.

Those settlements, ranging from 15% to about 20%, were the ones that caught the public attention, but there were many others, affecting many times the number of workers covered in key cases. The American Federation of Labor, for instance, recently announced that 2,500,000 of its members have received 10% to 20% increases in pay since V-J Day, and official Washington placed the number of authorized pay increases in excess of 6,000,000, with the raises ranging from a few 5% hikes to some very near to labor's current goal of 30%.

Pricing Crisis Substituted

With the growing trend toward settlements, 15% to 20% in metal-working and in mass industries, 10% to 20% in general industry, the wage problem was dwarfed, as far as management was concerned, by a pricing crisis. It no longer was a matter of whether, and how much, wages would go up, but whether industry would be able to get the price boosts necessary to permit it to foot the increased bill.

Thus, with the United Steelworkers of America (C.I.O.) willing and anxious to accept a Washington-ordered compromise of 18½c an hour as the figure for a raise in steel wages, U. S. Steel delayed raising its offer of 15c while the question of an increase in steel prices was argued in the nation's capital. While steelworkers picketed and the nation lost, by Feb. 4, some 3,000,000 tons of steel ingots, the question was whether steel prices would rise $2.50 a ton, the amount favored at first by the Office of Price Administration; $4 a ton, as suggested privately in government circles as a basis for an 18½c an hour pay rise, or about $6 a ton, as demanded by U. S. Steel.

G.M. Situation Knotty

The wage-price connection was not nearly as obvious in the General Motors situation, where some 225,000 members of C.I.O.'s United Auto Workers would settle for 19½c an hour, or about 17.4%, the figure recommended by a presidential fact-finding board, while G. M. was standing pat on an offer of a 13½c an hour pay rise. U.A.W. said it did not want a raise which would force auto and truck prices up—a position which has caused bitter internal ructions in C.I.O., particularly in Philip Murray's steel union. But it was apparent that Washington was thinking in wage-price terms for G.M., too.

The job of getting G.M. and U.A.W. together for renewed negotiations was placed into the hands of James Dewey, as mediator. He succeeded in clearing up an equally serious situation in the 1937-1940 strikes in Detroit.

Electrical Strike Damaging

In the electrical manufacturing industry, whose shutdown has caused severe headaches in the metal-working industry by blocking off supplies of motors and other electrical assemblies, the wage-price tie-up was clearly indicated by the presence of Charles E. Wilson, president of General Electric, in Washington—where price policies are set—instead of in New York, where two government mediators sought to end a strike of 200,000 members of the United Electrical Workers (C.I.O.) in G.E., Westinghouse, and the electrical division of General Motors. Industry spokesmen have long complained that as long as present ceilings prevail, production—even without new wage increases—cannot be profitable. U.E.'s negotiators have offered to compromise on an immediate 15c an hour increase, and to reopen negotiations for an additional 10c an hour later.

The three major strikes, steel, G.M., and electrical manufacturing, involved two-thirds of the total strikers listed in Washington, and settlements in them will mean an end to an all-time high for strike idleness in this country. Minor strikes will continue—although such situations as the farm equipment workers' walkout at International Harvester and Caterpillar won't last many days after policy-setting strikes end—and new ones probably will arise, in for instance, coal mining.

3,000,000 Tons of Steel Lost—Workers get paid at Gary, Ind., plant of Carnegie-Illinois Steel Corp. just before the industry-wide strike, paralyzing 95% of the nation's steel capacity. Major attention centers on U. S. Steel negotiations, but other steel companies say they may not be able to meet big steel's agreement

Spotting the Air News

Jet Power Weight

Turbojet aircraft power is the main salient of aeronautical progress, and Britain is leading the U. S. in that field. The U. S. Lockheed P-80 Shooting Star and the Bell XP-83 jet planes have a power loading of 3.4 pounds per pound of engine thrust, while the British Gloster Meteor has a loading of 3 pounds. The Germans got down to 3.85 pounds in the Messerschmitt 262, and only 2.8 pounds on the Heinkel 162. The British also are far ahead in size of engines, having achieved 8000 pounds of thrust in their BMW 028, 7500 pounds in their BMW 018. Biggest U. S. engine so far has 4000 pounds—the G. E. 1-40. Of course all projects here and abroad have not been revealed.

Farm Plane Market

Years of predictions that American farmers would use airplanes extensively have not materialized. Harry Woodhead, president of Consolidated-Vultee, still thinks farmers will go for airplanes on large scale, because they have space for flight strips, barns for storage, distances to travel, and such jobs as crop spraying, marketing in town, and the same travel desires as other people.

Propeller Protection

Because revolving propellers endanger bystanders, Thomas Mountjoy, of Riverdale, Md., associated with Engineering Research, which builds the popular Ercoupe, has designed a light pusher plane with its propeller on the tail, mounted in a flat ring, like a blower fan. In addition to acting as a guard, the ring can be made hollow to serve as an exhaust muffler, and also it will help to dampen propeller noise, which is a serious problem for community airports. The ring arrangement was advocated some time ago by John Geisse, private flying consultant to CAA. The Mountjoy plane is not yet scheduled for production.

CAA Budget Boosted

The President's Budget message to Congress recognizes the switch from military to civil aviation. Civil Aeronautics Administration is recommended for an increase of 36% over 1946 expenditures (estimated) of $51,090,000. However, CAA lost a request for $1,000,000 to aid development of light airplanes. Its greatest increases are in radio and radar, which are essential if the airlines are to fly all-weather schedules in competition with super-trains. National Advisory Committee for Aeronautics, whose basic research is shifting to civil aeronautics, gets $500,607 over its 1946 expenditures of $26,500,000; the increase is already approved by the House Appropriations Committee.

Aviation Merger Aspects

Toughest problem before Congressional committees working out a plan for merging Army and Navy and creating a co-equal Air Force is the separation of land and ship-based aviation. President Truman's plan calls for placing all land-based aviation in the Air Forces, and deck-based air power with the Navy arm. In the past, however, Navy has used many land-based planes; and the Army has done a lot of overwater flying, about which it has quarreled with the Navy. Then, there is the problem of training, which, in accordance with objectives of the merger, should be consolidated. The future Navy will be a sea-borne air force, and it will be in conflict with the interests of the land-based air force, and no amount of merging will stop it. The merger plan is to set up a Department of Common Defense, with a civilian cabinet head, under whom will be undersecretaries of Army Forces, Air Forces, and Navy Forces.

Canadian Ford Non-union Workers Forced to Pay Dues in New Ruling

OTTAWA—In the sprawling Ford factory at Windsor, Ont., a new experiment in industrial relations has begun. There is union security without compulsory membership and a measure of security for the company against irresponsible strikes.

Briefly the Rand formula (laid down by Justice Ivan C. Rand) is that the checkoff for union dues must apply to every employee but employees need not be members of the union; that no strike can be called unless all employees, UAW-CIO, union and non-union, vote in favor by a majority at a poll supervised by the Ontario department of labor, that penalties apply to individuals for participating in unauthorized strikes and to the union for failure to outlaw a strike called in a manner not prescribed by the arbitration award.

Labor Jubilant

The formula was accepted with considerable jubilation in labor circles, but with some reservations in governmental and employer circles, that in effect if not in words it means compulsory union membership. The satisfaction in union circles sprung from the acceptance by the judge of the principle that a worker who benefits from union activity in his shop should pay his share of the cost.

Judge Rand stressed that in his view it was not necessarily suitable to other industrial situations. In his review of the background and conduct of the strike he was equally rough on the company and the union. Primary responsibility he placed on the company which he charged with holding the "absolutist conception of property," a position which could only engender tension and hostility. He rapped the union for illegal picketing and public authorities for tolerating it. Filling of the street alongside the plant with vehicles was an insolent flouting of public order."

Wage and hour matters involved in the Ford dispute are left to negotiation. The employees are demanding an annual minimum wage of $1800 with a 40-hour week without reduction of take-home pay.

Strike Penalties Imposed

Penalties proposed for illegal strike action mark the first attempt to impose responsibility on unions in Canada. Union officers are required to repudiate any unauthorized strike within 72 hours of its outbreak and declare that any picket line set up is illegal and not binding on union members. If they fail to do that the union may be penalized by suspension of the check-off for from one to six months at the discretion of the company. An employee participating in an unauthorized strike is made liable to a fine of $3 for every day's absence from work and to a loss of one year's seniority for every continuous absence of one week or part of one.

Union Shop Denied

In rejecting the union claim for a union shop the jurist said: "It would deny the individual Canadian the right to seek work and to work independently of personal association with any organized group. It would also expose him, even in a generally disciplined organization to the danger of arbitrary action of individuals and place his economic life at the mercy of the threat as well as the action of power in an uncontrolled and, here, an unmatured group."

Metal Show, Largest Ever, Has Record Attendance; Swope Awarded ASM Medal

CLEVELAND—Thousands of metalworking executives and engineers jammed the Public Auditorium here to attend the 27th National Metal Congress and Exposition, held under the sponsorship of the American Society for Metals. About 350 leading manufacturers serving this field exhibited their equipment and services making it the largest industrial show ever.

Thirty-one technical papers, four educational courses, and three round-table evening sessions featured the program, and four important awards were made for outstanding achievements in the industry. Gerard Swope, of General Electric Co., New York, received the ASM Medal for the Advancement of Research in recognition of his role in many recent metallurgical developments. Earle C. Smith, chief metallurgist, Republic Steel Corp., Cleveland, received the A.S.M. Gold Medal for outstanding knowledge and ability in solving diversified metallurgical problems. Mr. Smith's work on the effects of grain size and the development of "contact metallurgists" was particularly cited.

Other Awards Made

Robert S. Archer, metallurgical assistant, Climax Molybdenum Co., New York, was presented the 1945 Sauveur Achievement Award for proven achievements in the metal industry. His greatest contributions have been in the field of fabricating, compounding, and heat treating of aluminum alloys, and he has a long list of patents to his credit. The 1945 Howe Medal for the authors of the most meritorious paper presented before the ASM during the past year was presented to Dara P. Antia, Stewart G. Fletcher and Morris Cohen for the paper, "Structural Changes During the Tempering of High Carbon Steel." Dr. Cohen is associate professor of physical metallurgy at M.I.T., Dr. Antia is with the Indian Aluminum Co., Calcutta, and Stewart G. Fletcher is chief metallurgist, Latrobe Steel Co., Latrobe, Pa.

Campbell Lecture Delivered

A highlight of the well-rounded technical discussions presented was the Eward de Mille Campbell Lecture delivered by Maxwell Gensamer of Pennsylvania State College. Papers were also presented by the American Industrial Radium and X-ray Society.

Earle C. Smith

Officers of the American Society for Metals include: President Chas. H. Herty, Jr., assistant vice-president, Bethlehem Steel Co., Bethlehem, Pa.; Vice-president—A. L. Boegehold, head of metallurgy department, Research Laboratories Division, General Motors Corp., Detroit; Treasurer—Dr. H. K. Work, manager of research and development, Jones & Laughlin Steel Corp., Pittsburgh; and Secretary—W. H. Eisenman. Past President is Dr. Kent R. Van Horn, assistant manager, Cleveland Research Division, Aluminum Co. of America, Cleveland.

A. S. M. OFFICERS

C. H. Herty, Jr.

A. L. Boegehold

W. H. Eisenman

H. K. Work

Steel Shortage Forces Midwest Plants Down; Thousands of Workers Laid Off

CHICAGO—At their peak, metalworking and electrical equipment strikes in this area have directly affected over 100,000 workers. Many factories, not strikebound were forced to curtail operations as much as 50%. Although larger firms at the outset of the steel strike reported average inventories of steel sufficient to last 30 days, smaller companies were in a more vulnerable position.

While Chicago metalworking firms are highly diversified, steel is a major requirement for most of them. Industries that have reported acute metal shortages include radio producers, foundries, auto equipment makers, and manufacturers of consumer durable goods such as stoves, washing machines and water heaters. Other firms who still had some steel left, halted operations before their stocks were entirely used up, because they realized that it would take several weeks after the strike ended before stocks could be built to a better operating level. By closing up now, they can get off to a faster start later.

Shutdowns Growing

A survey of some representative plants and industries disclosed that: Rheem Manufacturing Co. closed two plants and laid off 750 workers. Continental Can's output of some items has virtually ceased, and others could only be turned out for a few weeks unless the steel strike ended. Although Borg Warner's inventories run from 1-8 weeks' supply, its Chicago Heights re-rolling mill was closed by the steel strike. With its workers belonging to the steel union, General American Transportation Corp.'s plants were shut down. Edison General Electric Corp. is hit by lack of GE and Westinghouse components interrupted by the electrical strike. The repair shops of Illinois Central were closed due to steel shortages, and 600 workers were laid off. Ford Motor's Torrence Avenue plant planned to shut down due to lack of steel, throwing 2,500 employees out of work.

In the Chicago area alone, 15,000 International Harvester workers are on strike, although one-fourth of its productive capacity is still operating, including three motor truck factories and five other plants.

Optimistic Notes

Present conditions seemed all the more distressing to manufacturers with the disclosure that the Chicago Ordnance District had turned out more than five billions in war materiel, a higher war record than any other district except Detroit.

A few other optimistic notes serve to lighten the general gloom caused by the labor unrest. Pullman-Standard Car Manufacturing Co. reports a $180,000,000 order backlog, including 1,100 postwar type cars. Federated Metals Division of American Smelting & Refining has completed a new $100,000 physical laboratory for testing nonferrous metals. Metals Refining Co., Hammond, Ind., intends to double capacity for powdered metals.

Warner & Swasey Maintains Full Employment by Diversification

CLEVELAND—To the question "How can we profitably employ the war-expanded capacity of our plant," Warner & Swasey Company has two answers, diversification of output and intensifying of machine tool activity.

Entry of the company into the road machinery field, with manufacture of a new grading machine trade-named "Grade-all," is an important step in the program. This hydraulically-operated machine, invented by Ray Ferweda, Cleveland contractor, and built by Warner & Swasey under his patents, will be sold by distributors in the road machinery field. Welding technique and experience gained by the company in manufacture of radar antennae was employed in fabrication of the 24-foot expandable boom of the grading machine.

Other Lines Added

Added to the textile equipment manufacturing program of the company, which already includes production of a gill box for the Huxbridge Worsted Company, is a Trico knitting machine. This is a cooperative design effort with American Viscose Co.

Tapping and threading machines, which have been added to the company line during the war, will be modernized in the machine tool program. Along with this expansion will go the design and manufacture of chucks and multiple spindle automatics. Quick set-up, elimination of cams and other features of these units point to a ready acceptance by industry, particularly in small plants.

Truck Bookings Up 18%

CHICAGO—September, 1945, domestic bookings of electrical industrial trucks and tractors totalled 423 units at $1,809,408, while cancellations totalled $694,285. After cancellations, net new business was still 18% above the August total bookings of $949,473.

MEETINGS

American Society for Testing Materials. Spring Meeting, Hotel William Penn, Pittsburgh, Pa., Feb. 25-March 1. C. L. Warwick, secretary, 260 So. Broad St., Philadelphia 2, Pa.

American Society of Tool Engineers. New Era Exposition. Cleveland Public Auditorium, Cleveland, Ohio. April 8-12. C. V. Briner, president, 1666 Penobscot Bldg., Detroit, Mich.

Society of the Plastics Industry. National Plastics Exposition. Grand Central Palace, New York, N. Y. April 22-27. W. T. Cruse, executive vice president, 295 Madison Ave., N.Y.

Names in the News

Lt. Gen. L. H Campbell

Lt. Gen. Levin H. Campbell, Chief of Ordnance of the United States Army, has been elected a vice president of the International Harvester Co. Gen. Campbell is retiring from the Army Feb. 13 and will join Harvester on March 1.

Gwilym A. Price has been elected president and chief executive officer of the Westinghouse Electric Corp., Pittsburgh, to succeed **George H. Bucher,** who has been named chairman of the board. Mr. Bucher will, also, continue as chairman of the board of Westinghouse Electric International Co. Mr. Price, former president of the People-Pittsburgh Trust Co., is a director of Blaw-Knox Co.

Palmer A. Dolf has been elected vice president of Continental Motors Corp., Detroit, and will serve as assistant sales manager of the engine division.

Harry M. Heckathorn, operating vice president since 1938, has been appointed executive vice president of the Mullins Manufacturing Corp., Warren, Ohio.

John A. McCone has been named president of the Joshua Hendy Iron Works, Sunnyvale, Calif., to replace **Charles E. Moore,** resigned. Mr. McCone was recently executive vice president and general manager of Consolidated Steel Corp.

Edward Riley, vice president of General Motors Corp., has been named to succeed **James D. Mooney** as group executive in charge of overseas operations.

Carl H. Kindl has been named vice president in charge of manufacturing for the Aviation Corp.

Curtis H. Carr, sales manager since 1940, has been elected vice president of the Universal Tool Co., Dayton. Ohio.

H. G. Sharp has been named general manager of The Graver Tank and Manufacturing Co., Inc., East Chicago, Ind. At the same time, **William G. Shipman** was appointed plant superintendent at the East Chicago plant.

George D. Behlan, former chief engineer and production manager of the U. S. Electrical Tool Co., has been named to head the electrical tool division of the Bradford Machine Tool Co., Cincinnati.

Jack Green has been appointed sales manager of the welding fittings division of Tube Turns, Inc., Louisville, Ky. **Tom Pike** has been named to succeed Mr. Green as assistant sales manager of the division.

George W. Veale

G. V. Slottman

George W. Veale, a vice president of the Eaton Manufacturing Co., has been appointed general manager of the company's axle division in Cleveland.

Dr. George V. Slottman has been named to head the new technical sales division, replacing the former applied engineering department, of the Air Reduction Co., New York.

Arthur A. Ladwig, works manager of the LeRoi Co., Milwaukee, Wis. since 1942, has been appointed vice president in charge of manufacturing for the firm.

Several new welding engineers have been appointed by the Lincoln Electric Co., Cleveland. Those named include: **Omer W. Blodgett** for the Grand Rapids, Mich., area; **Frank Boucher** in Detroit; **R. K. Kewley** in Cleveland; **G. B. Moseley** for St. Louis, Mo.; and **L. J. Cogan** has returned to Philadelphia.

Frank R. Markley has been appointed general sales manager of the Sun Oil Co., Philadelphia. Mr. Markley was formerly manager of the company's industrial products department.

Harry Crump, recently assistant to the vice president, Carboloy Co., Inc., Detroit, has been advanced to the position of chief tool sales engineer.

O. P. Adams, formerly assistant general superintendent of the National Tube Company's National Works, McKeesport, Pa., has been named director of development for the firm. Also, **E. G. Price** succeeds **R. M. Overton** as general superintendent of the National Works.

L. M. Weaver is now sales manager in charge of the Celfor Drill and Cutting Tool Div., Clark Equipment Co., Buchanan, Mich.

Raymond R. Wiese, formerly administrative engineer of the Fleetwings Div., Kaiser Cargo, Inc., Bristol, Pa., has been appointed assistant to the division manager.

Everett L. Morgan, for many years treasurer of Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn., retired Dec. 31 and was succeeded by **Richard W. Banfield,** secretary and office manager of the division. Mr. Morgan retired after 48 years of continuous service with Niles-Bement-Pond.

John A. Bauer, who has been assistant sales manager of the Hanson-Van Winkle-Munning Co., Matawan, N. J. since 1939, has been made sales manager of the firm.

Seth H. Stoner has been appointed assistant chief engineer in charge of automotive and tractor applications at the New Departure Div., General Motors Corp., Bristol, Conn.

C. W. Ginter, associated with The Aro Equipment Co., Bryan, Ohio, since its organization 16 years ago, has been appointed vice president of the company.

Richard M. Johnson has been named assistant sales manager of The Chandler-Evans Corp., West Hartford, Conn., subsidiary of Niles-Bement-Pond Co.

BUSINESS ITEMS

The **American Machine Tool Export Associates** has added the three following machine tool manufacturers to its group: **Leland-Gifford Co.,** Worcester, Mass.; **Taylor-Winfield Corp.,** Warren, Ohio; and the **Barber-Colman Co.,** Rockford, Ill.

The **Hill Acme Co.,** Cleveland, has appointed **Giebel, Inc.,** of 250 W. 57 St., New York City, and 152 Temple St., New Haven, Conn., as its exclusive representative in the sale of "Hill" open side hydraulic surface grinders in Conn., northern N. J., and eastern N. Y.

American Brake Shoe Co., New York City, has purchased **Joliette Steel, Ltd.,** of Canada. The company will be operated under the direction of Brake Shoe's American Manganese Steel Div. **Joseph B. Terbell** will head the company, while **J. L. Mullin** will serve as vice president.

The West Co., Inc., Philadelphia, has sold its abrasive division to the newly organized **West Abrasives, Inc.,** associated with **General Grinding Wheel Corp.**

The Lodge & Shipley Machine Tool Co., Cincinnati, has appointed **The Rudel Machinery Co., Inc.,** with offices in the Statler Building, Boston, as its exclusive sales representative and dealer in the northeastern states.

The Rockwell Manufacturing Co., Pittsburgh, has acquired **The Arcade Mfg. Co.,** Freeport, Ill.

International Harvester Co. has established a Pacific coast truck manufacturing plant at Emeryville, Calif., to produce heavy-duty gasoline and diesel trucks. **Arthur W. Engstrom** is manager of the plant.

The **National Tool & Machine Co.,** 426-28 West 55 St., New York City, has changed its name to the **Transomatic Corp. of America.**

The **Motorette Corp.** has recently been formed at 1560 Harlem Rd., Buffalo, N. Y., to manufacture a new auxiliary vehicle — a combination scooter and small car. Officers of the new company include: **Stephen A. Buckholtz,** president and general manager; **W. Kenneth Breckenridge,** secretary and sales manager; and **John C. Parkin,** vice president and chief engineer.

The **Sutton Tool Co.,** Sturgis, Mich., has appointed the **Collier Co.,** 8015 Carnegie Ave., Cleveland, as its sales and engineering representative in northern Ohio.

Davey Compressor Co., Kent, Ohio, has appointed the three following new dealers to handle its line of portable and stationary compressors: **B. & H. Construction Equipment Co.,** 835 Meeting St., W. Columbia, S. C.; **A. L. Barnum & Son,** Seneca Blvd., Burdett, N. Y.; and **Burton Equipment Co.,** New Orleans, La.

OBITUARIES

Charles Borland

Elmer H. Neff

Charles Borland, 68, president of the Federal Electric Co., Chicago, died Jan. 3. He joined Federal in 1926 as general manager and a year later was elected a director of the company. In 1934 he was elected president of the concern.

Elmer H. Neff, 79, head of the New York office of the Brown & Sharpe Mfg. Co. for 40 years, died Jan. 26. Mr. Neff joined Brown & Sharpe in 1896 and a year later was named manager of the New York office, a position which he retained until his retirement in 1937. Since then he has served in an advisory capacity.

Henry Toothill, 91, former operator of the Toothill Plating Works, Rochester, N. Y., and inventor of numerous metal devices, died recently.

James P. Allen, 74, former president of the Union Steel Casting Co., Pittsburgh, passed away Jan. 23. Mr. Allen joined Union Steel in 1902 as sales manager. In 1929 he retired as president and became a director of the Blaw-Knox Co.

William Hill, 86, for many years president of the Hill Manufacturing Co., Buffalo, N. Y., pioneer manufacturer of automobile bodies, died Jan. 11.

Joseph Blakeslee, 63, passed away Jan. 21 after a three-month illness. He had been associated with the Buffalo Mill Supply Co. for 25 years, and in 1940, organized his own company.

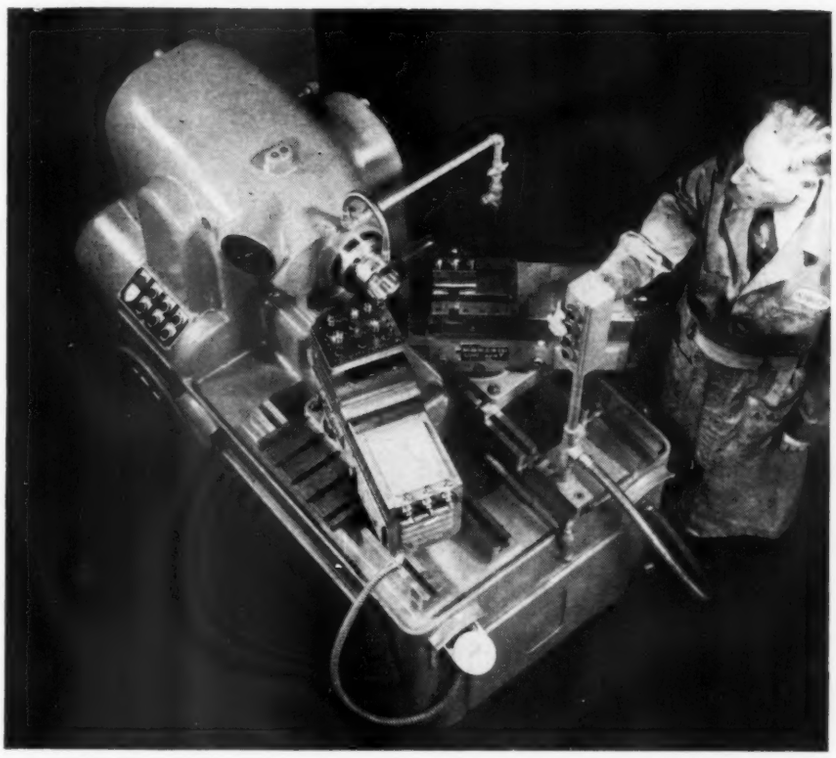
Louis C. Ducro, 81, retired head of the Ducro Engine Co., died recently in Buffalo, N. Y.

Joseph L. Thistlethwaite, 74, co-founder and treasurer of the Ontario Drill Co., East Rochester, N. Y., died Jan. 16.

Charles H. Sanderson, 94, co-founder of the Enos & Sanderson iron and steel foundry, Buffalo, N. Y., passed away recently.

Shop Equipment News

Single Heads and Slides Tailor Monarch Uni-Matic to the Job



Monarch Uni-Matics consist of two elements, a powered head and one or more powered toolslides. The slides can be placed in position and, by means of the electronic control selector, can be made to operate to best perform the necessary machining operations

A turning machine, the Uni-Matic, is announced by the Monarch Machine Tool Co., Sidney, Ohio, for performing turning, facing, and boring operations. The machine consists essentially of two members: a simplified version of the conventional lathe base and headstock, with change gears, motor and associated drive mechanism; and from one to three specially designed individually motor-driven tool slides which are mounted on swiveling bases, permitting turning, facing, and boring operations from any angle.

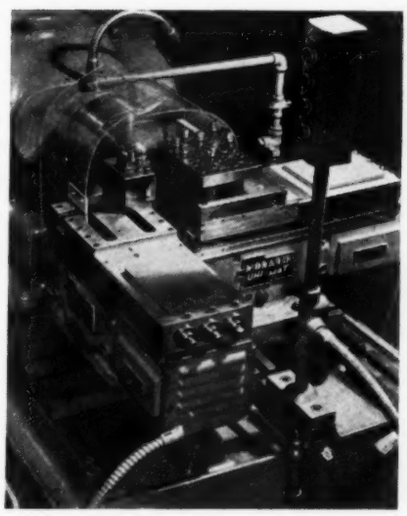
These tool slides, Uni-Mats, are individual motor-driven compound rests which can be grouped about the spindle in whatever arrangement will best facilitate the application of the tools to the work.

Each Uni-Mat is equipped with an electrically controlled ac. motor which traverses the main slide of the device at 100 in. per minute until automatically slowed to a predetermined feeding rate for the remaining part of its total travel of 4 in. At the end of the feeding cycle, it can immediately revert to 100 in. per minute rapid traverse return or dwell return, or dwell a given number of seconds before returning to its starting point. Three adjustable micrometer stops at the end of the Uni-Mat control the feeding and traversing elements of the cycle. The portion of the automatic cycle concerned with the rate of feed is controlled on a single purpose Uni-Mat by sets of change gears which make it possible to secure from ½ in. per minute to 13 in. per minute feed.

The Uni-Mat is also furnished driven by a dc. motor so, with two sets of change gears, it is possible to secure the entire feeding range from ½ to 13 in. per minute through the variation in the speed of the motor and the change of feed gearing.

When the Uni-Mat is driven by a dc. motor, top motor speed creates a rapid-traverse motion of 100 in. per minute. The feeding rate is then controlled entirely by a lower speed of the motor, which is electronically actuated.

The Uni-Mat slides, regardless of their type of initial drive, are built in two models, one equipped with tool relief, the other with a solid top slide. The one equipped with tool relief is designed so the tool relief slide and the regular top slide will traverse at 100 in. per minute. However, as soon as it starts its cycle the tool will move 0.031 in. closer to the work. By an internal adjustment, the tool relief can operate in either direction, with reference to the longitudinal or the feeding direction of the slide, making it good for turning



Each slide can function individually, without interference by the function or cycle of another

operations, facing operations and boring operations. As soon as the Uni-Mat slide has completed the feeding portion of its cycle and is at the end of the dwell (if used), the tool relief again functions, taking the tool away from the work 0.031 in., as the rapid traverse takes the slide back to the starting point.

The only connection between the slides with which the Uni-Matic is equipped, is the cable which carries the control circuits. The electronic equipment is in a separate control cabinet, designed so all wiring, relays and other electrical equipment are accessible for maintenance inspection. All devices are of standard design with 300% overload capacity. Multiple contacts are used so there is little chance of failure to function.

Since the only connection between the Uni-Mat slides which move the tool through the automatic cycle is this one cable, it is possible to position each unit individually with the work. The only moving slide on the Uni-Mat is directly below the cutting tool and the Microswitches which control the functioning of this automatic cycle of the slide are mounted in a 1 to 1 relation to the motion of the tool slide. With all other members clamped tightly, it is possible to obtain more accurate duplication of the machining cycle than is possible through hydraulic or cam operation. Duplication within ±0.0003 in. is possible.

The Uni-Mats can be positioned for work 1 to 16 in. dia. with tool support on all diameters. Each time a Uni-Mat slide is moved from one position to another, the supporting slide moves with it, making it possible to take the same chip in section on a large or small diameter.

As the Uni-Mats are electrically controlled, several timing devices have been utilized to maintain any required relation between the cycle of one Uni-Mat, the cycle of a second and a third. After the Microswitches have been positioned to control the cycle, it is possible to re-time the slides with reference to each other so that there will be no lost time between the functioning of the individual slides. This close timing is made possible by changing the electrically interlocked timers.

The main drive spindle of the Uni-Matic has been designed so the ball bearings at front and rear can be properly adjusted on the bench and, when inserted into the headstock housing, will retain perfect adjustment.

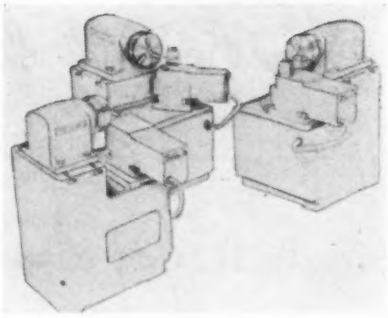
Directly behind the front spindle bearing is a gear attached permanently to the spindle through which the final drive to the spindle is transmitted. This final drive gear can be one of three sizes: one of very large diameter for low-speed, high-torque operations; one of medium size for medium-speed, medium-torque operations; or a smaller gear for high-speed, low-torque requirements. Since this change of ratio is in the final drive, three different spindle-speed ranges are available from the one motor.

One spindle-speed range has a top of 1000 rpm., the second is 2000 rpm. for medium-speed operations and a top speed of 3000 rpm. is provided for high-speed, low-torque operations. The lubrication of the main drive of the Uni-Matic is furnished either by means of a pump or atomized depending on operating speeds.

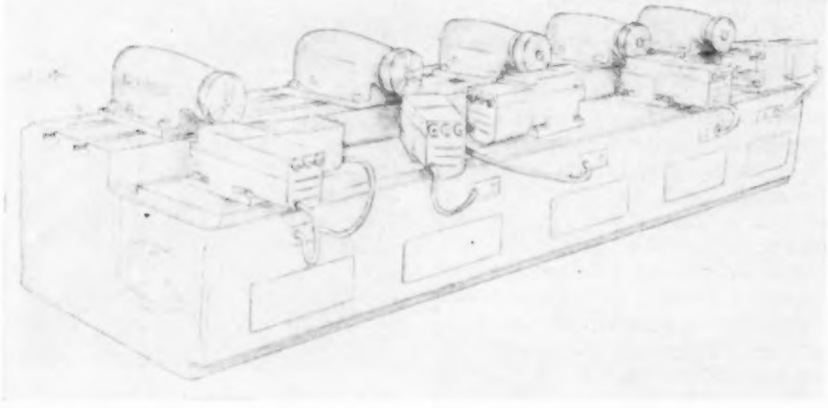
The remainder of the mechanism through the headstock or main drive to the spindle remains the same with the exception of a series of change gears which can be used with an ac. motor to obtain varying speeds below the top speed range of the spindle.

When the ac. motor is plugged, the spindle will stop in slightly over one second if it is operating at 3000 rpm. Similarly, when the main drive motor is started and directly connected through the mechanism to the spindle, the latter will reach 3000 rpm. in slightly over one second. This makes it possible for small operations to be performed with efficiency.

While specifically designed for single-purpose, large-quantity production, the Monarch Uni-Matic can be applied, with slight alterations in the electrical control, to smaller quantity production and still give maximum output with relation to any other type of turning, facing or boring equipment. With a dc. motor for the main drive, the spindle speed can be controlled quickly through a rheostat or potentiometer, for changing from one type of work to another. At the same time, the individual Uni-Mats can be driven by a dc. motor so they can give the necessary rate of speed. This eliminates change gears which might be required with ac. motors.



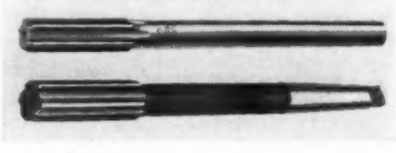
As the base and operating units are compact, several Uni-Matics can be grouped and the cycles controlled for servicing by one operator

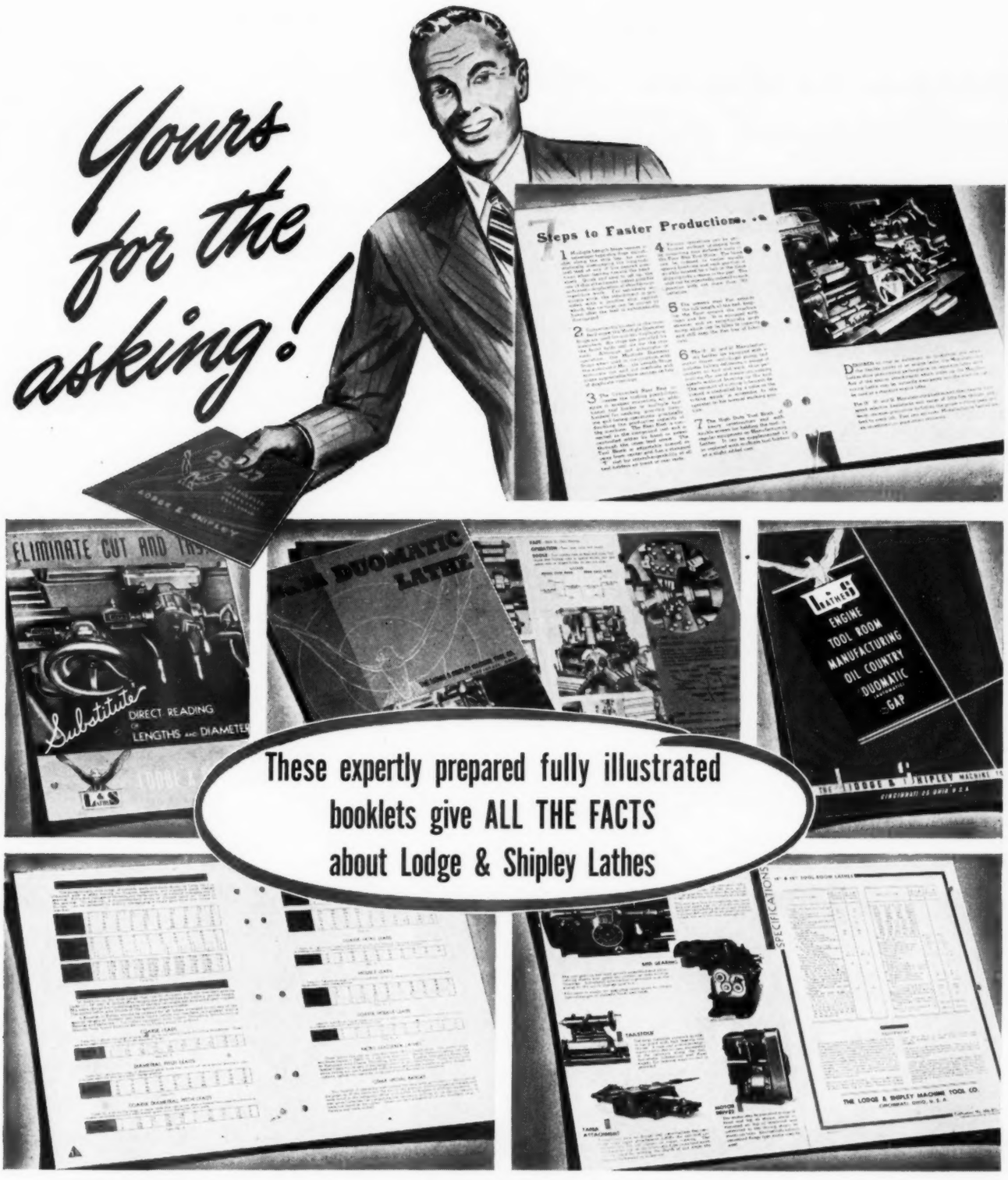


The Uni-Matic heads and slides can be mounted in gangs, to perform consecutive operations, on a common base and controlled by one man

Carbide-Tipped Solid Reamer Reduces Seizures in Metal

A carbide-tipped solid reamer with the tips extending the full length of the fluted section of the tool has been developed by Super Tool Co., 21650 Hoover R. I., Detroit 13, Mich. Scoring or galling is reduced to the minimum, particularly when reaming in cast iron and other very abrasive materials.





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Monarch Produces Versatile High Production Hand Screw Machine

A high-production hand screw machine, the Speed-Matic, with power-feed ram turret, hand-operated cut-off slide, and pre-selected changeable spindle speeds (from 50 to 5000 rpm.) is announced by the Monarch Machine Tool Co., Sidney, Ohio. It is designed to handle small turning work in quantities of 25 or more pieces with quick setups.

The base upon which the bed is mounted is a one-piece casting with sufficient wall thickness to maintain proper alignment under severe conditions. The bed is of special cast iron which includes 30% steel and 3% carbon so the bed ways, after being flame-hardened and precision-ground, will hold accuracy over a long period.

The spindle has a 3-in. D-1 American cam lock spindle mounting and is made from high carbon steel, electric furnace hardened and ground. The spindle is mounted in ball bearings which allow it to operate at speeds up to 5000 rpm. The bore of the spindle will accommodate bar stock of ⅞ in. dia.

The gear box—with all moving parts electric furnace hardened and ground—permits two feeds to the feed rod. Either high feed or low feed can be obtained by shifting one lever on the gear box. Screw-cutting parts are not necessary.

The power feed turret has an additional six feeds to the turret slide which, multiplied by the high and low feed of the main gearbox, gives a range of 12 feeds. The feeds range from 0.0005 in. to 0.016 in. per revolution. The turret slide is manually operated by capstan handwheel and is power fed through the rod which connects to the main gearbox.

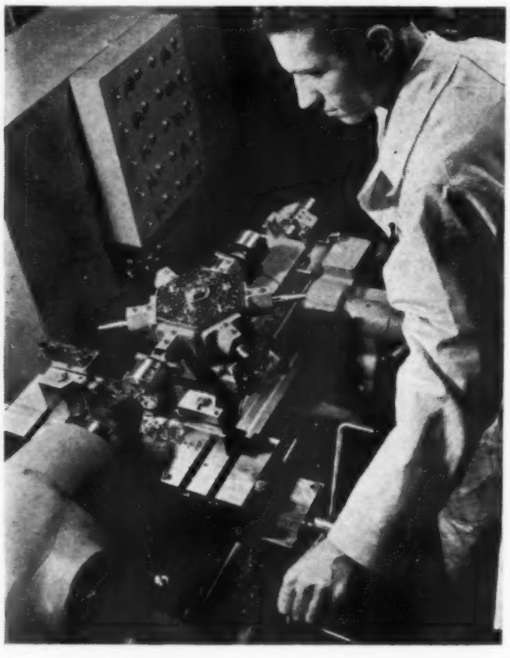
The six-way turret will index to six stations within 0.0002 in., out 2 in. from the turret face. The range of 12 feeds to the turret slide can be obtained by shifting two levers on the right-hand side of the power turret gearbox. This feature allows the operator to present the tools to work by manual operation at which time he can apply the power feed to the turret slide, thereby diminishing manual as well as power motion.

The hand-operated, air-fed pusher collet attachment supplies constant air pressure on the bar stock sufficient to feed stock through the collet, to a stop on one face of the turret. By opening and closing the collet, the bar stock is fed through it and held in position.

The self-centering ball-bearing cut-off slide, with front and rear blocks for holding tools, is presented to the work by turning a handwheel through 100° or less. Tools are then hand-fed to do forming, necking or cutoff. Upon completion of these operations, the self-centering slide, by means of spring and helical rack mechanism, is returned to its original position without the aid of the operator. This centralizes these tools and clears the turret tools.

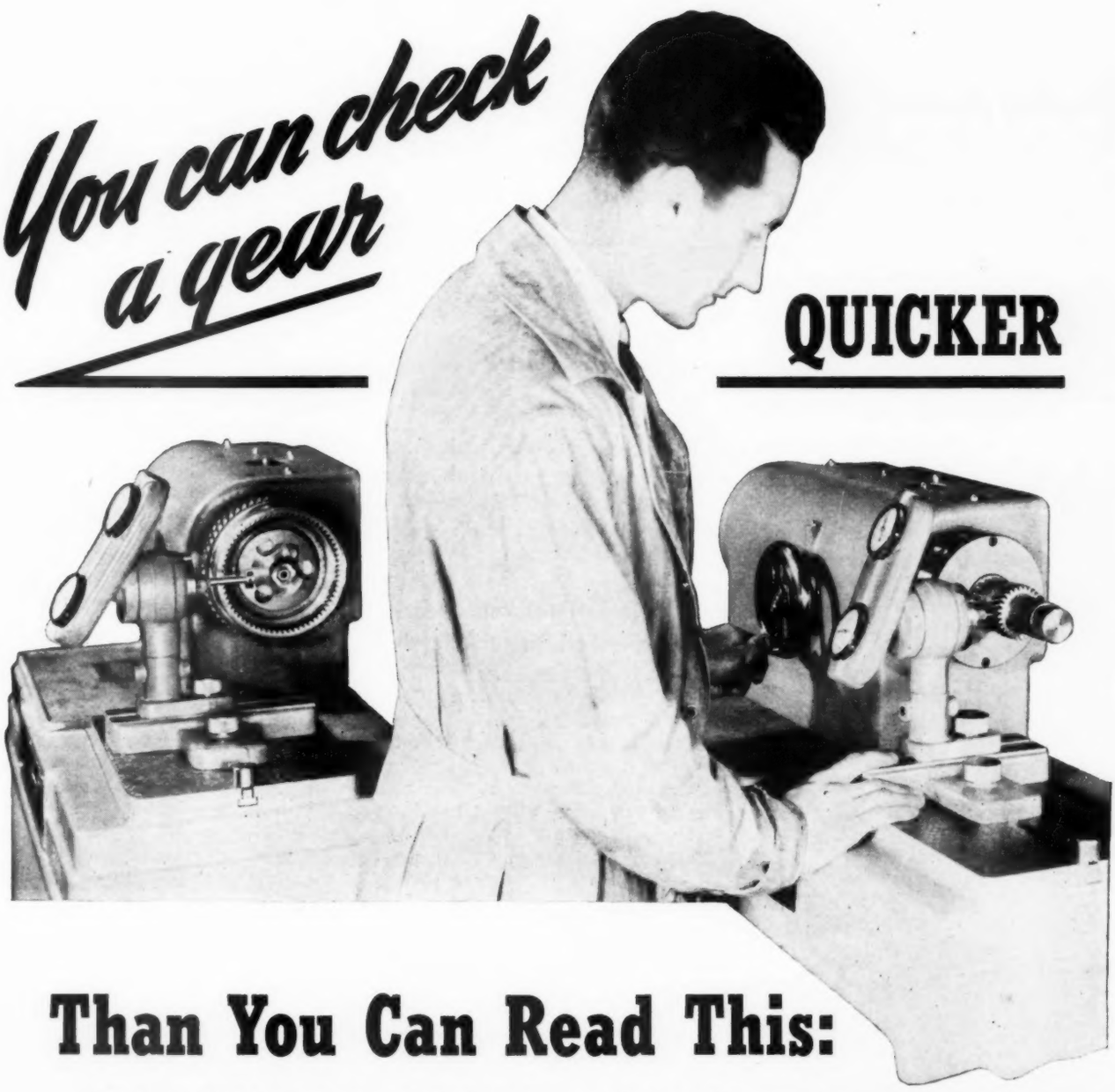
A 3-hp. Reliance variable-speed drive, complete with motor-generator set for converting alternating to direct current, is used to drive the machine. The relay panel for the machine houses potentiometers and other electrical equipment necessary for automatically changing spindle speeds to conform with the requirements of the tool for a particular operation. Spindle speeds for each face of the turret, as well as the cut-off slide, are pre-selected to their proper position by means of these potentiometers.

Whenever the turret indexes, as application is made of all tools, it comes back against the finger which automatically changes the speed for each operation by controlling the circuit through the potentiometers. This ten-station panel has six stations for controlling the six sides of the turret, two stations for the front and rear tools of the hand-operated slide, and two additional speeds for other operations such as forward or reverse speed for tap and die work.



Speed-Matic spindle speeds are changed, by means of selective potentiometer controls, for each face of the turret and cutoff slide

You can check a gear QUICKER



Than You Can Read This:

With a Michigan Series 1200* lead checker it is the work of only a few seconds to check both sides of four equally spaced teeth on a gear for lead, right alongside the gear finishing machine.

The machine is designed for shop use —in the open—requiring no covers, dust-protection, etc. To set it up for any gear it is only necessary to install the correct master lead. Once set up, it is a *foolproof* single purpose precision machine. Indexing is quick and positive. There are no settings to compute or individual set-ups to make.

It is easily re-set however. For a different size gear, just move the indicator mount in or out. For a gear of different helix, slip in the corresponding MULTIPLE-THREAD master lead. To check an internal gear, change the pointer on the indicator.

The two dial indicators are for checking facing tooth surfaces. The machine may be used to check an internal or external gear* up to 10 inch OD, in routine production—with laboratory accuracy.

For further data ask for Bulletin No. 1200-46.

**For gears with helix angles above 45° use a model 1200-A.*

ORIGINATORS of GEAR-SHAVING

MICHIGAN TOOL COMPANY

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Drafto Metal Disintegrator Improved to Drill Hard Metals

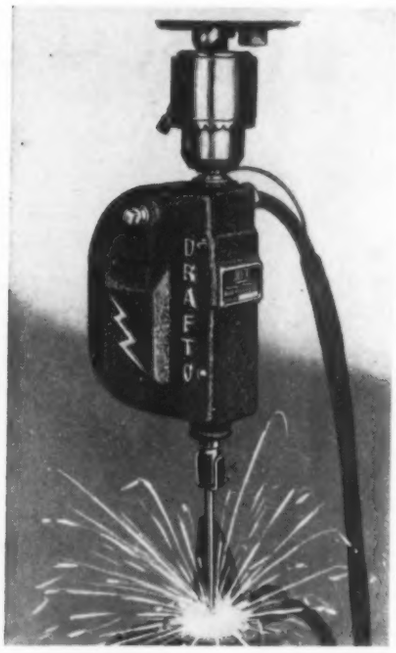
An improved type of metal disintegrator which removes broken taps and drills from work in progress is announced by Drafto Corp., Cochranton, Pa. Known as the Model 3 metal disintegrator, the machine works on the electrical sputtering principle, and is suitable for drilling hard metals.

The disintegrator will remove broken drills or taps from work, without in any way injuring the metal of the workpiece, regardless of the hardness of the metal. It is twice as fast as former models, and can bore through hardened high-speed steel at the rate of about 1/16 in. per minute.

It will drill round holes or holes of practically any shape through tungsten carbide and Stellite, and will cut all hard metallic materials.

Three models of the machine are available. Models A and B are floor models; are completely self-contained, and can be rolled to any part of the plant for use. Model C is a portable table or bench model, consisting of controls, transformer, coolant tank, pump and working head in a unit.

Reduction in the size of head component permits use of the Drafto disintegrator in inclosed spaces. As the principle of operation generates heat only in a restricted area, the device is suitable for extracting broken taps from iron castings. For drilling with the disintegrator, round, hexagonal and square electrodes, or special shapes, are available.



All three models of Drafto disintegrators have equal speed in cutting. The head will operate continuously without heating. The bearings are of tungsten carbide, assuring freedom from sticking and gumming. Oiling is unnecessary. Electrodes available range in sizes from 0.065 in. to 0.310 in. dia. and square electrodes up to 1/2 in. Stock electrodes are round, hexagonal and square in shape. Special shapes can be furnished on request

Pivot Blade of Steelweld Shear Permits Fast Knife Adjustment

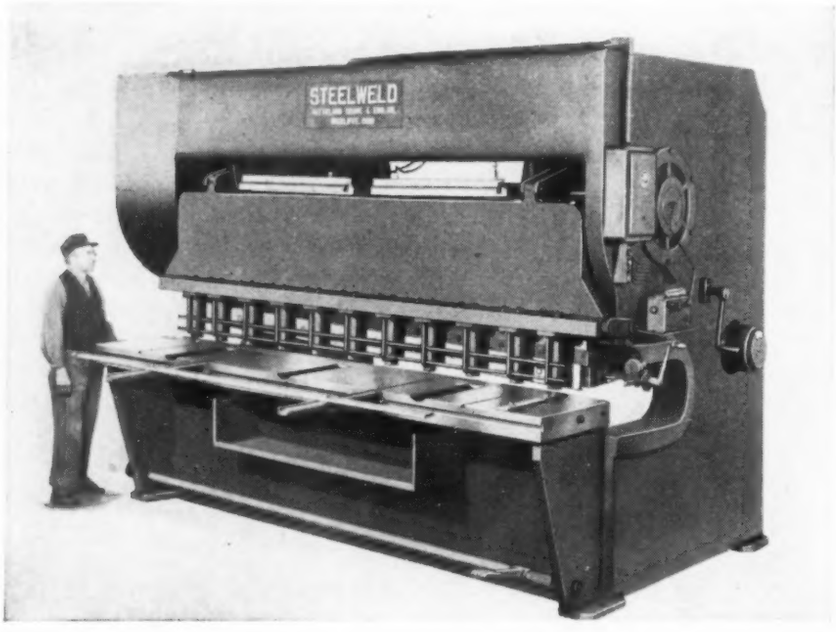
Cleveland Crane & Engineering Co., Wickliffe, Ohio, announces the Cleveland Steelweld shears, which employ a pivoted-blade principle. There are no slides or guides to wear and cause inaccuracies. The upper blade operates on two heavy pivot pins secured to the end housing and travels in a circular path. This construction permits adjustment of the shear blade to be made with movable pivot journals.

Knife clearance may be varied to suit the thickness of plate being cut. Turning a hand crank located on the right end housing changes the gap between the knives. A dial indicator indicates the clearance in increments of 0.001 in. and also shows the plate thickness that may be cut for any knife setting.

Steelweld shears may be arranged for squaring, slitting, or set at any intermediate position for notching and firmly locked. This feature is included on all machines with standard 24-in. deep throats, but is not furnished on the smallest size, where the throat depth is 18 in.

Both frame and blade are of all-welded steel, one-piece construction. Because the knife adjustment is made by movement of the upper blade, there is no need to move the bed. Consequently, the beds on Steelweld shears are welded integral with the frames. The crown is welded to both end housings.

Other features include heavy spring-operated mechanical hold-downs. A back gage mounted on ball bearings is provided. The operating crank and dials of the gage are at the outside front corner of the shear, accessible to the operator. The shear angle, or rake, is low, thereby minimizing end thrust on the plate and reducing twist, camber and bow in the cut pieces.



Steelweld shears have been developed in various sizes from cutting plate of all thicknesses from 12 ga. to 1 1/4 in. and for lengths from 6 to 16 ft. Speeds range from 60 strokes per minute on the smaller shears to 25 strokes per minute on the largest size

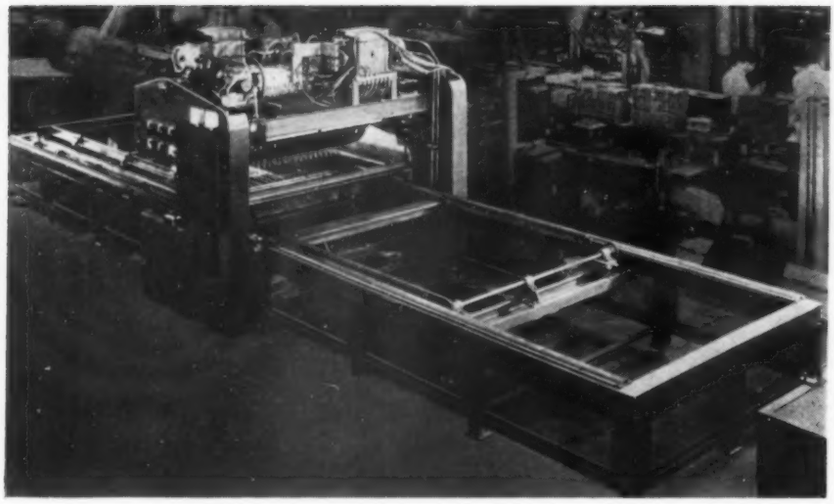
We'll lift the covers . . . IN MARCH

In this space, in March, we'll disclose three amazing new turning machines which Monarch has engineered expressly to meet rising production costs. However, if you'd like a quick "preview", we'll be glad to send you photographs and brief descriptions, immediately, with full details to follow the formal introduction. Write Dept. 201.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

ACCURACY · ECONOMY · LONG LIFE

Monarch
TURNING MACHINES



A progressive integral loading and clamping fixture mounted on a horizontal carriage is moved into the machine by hydraulic motor at high speed, automatically slows down and stops at first welding position within a tolerance of 0.010 in. Guns come down and forty series welds are produced. Guns raise while the carriage moves to the next weld position and the control unit returns to starting position. The cycle is repeated until the required number of double rows of welds have completed the assembly. The carriage moves through the machine to unload the assembly at the rear. Total time for welding each group is 15 sec.

Progressive Welder Control Unit Welds 900 Spots per Minute

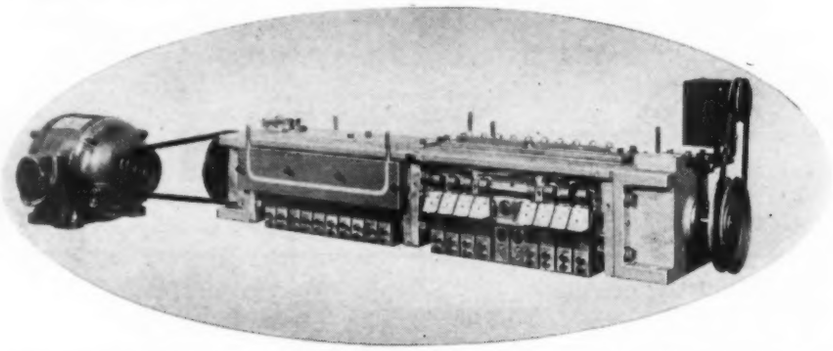
A welder control unit, built by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich., permits automatic assembly welding rates up to 900 spots per minute. The unit is included in all Progressive Ultra-Speed welding machines. It distributes welding current to single or to groups of welding points successively by means of a screw-driven carriage that depresses push rods to engage contacts. At the same time, another element of the carriage engages adjustable-stroke plungers to control, individually, the length of time the welding current flows for each weld. All welding points bear on the work simultaneously under welding pressure before the first weld is formed and remain until the last weld is completed, eliminating the separate squeeze and hold times usually required for each weld. Thus, 100 or more joints can be made in slightly more time than the total of the individual weld times.

Ultra-Speed controlled machines can be built to accommodate an unlimited range of weld spacings and locations. The welding guns can be arranged in single or multiple rows, circles, steps or curves, either closely spaced or spanning the full width of large panels. Individual timing of each welding gun permits spot-welding of different thicknesses of metals during one operation. Reinforcing sections, brackets, spacers and trim forms can be joined to a main panel using most suitable type and thickness of metal for each.

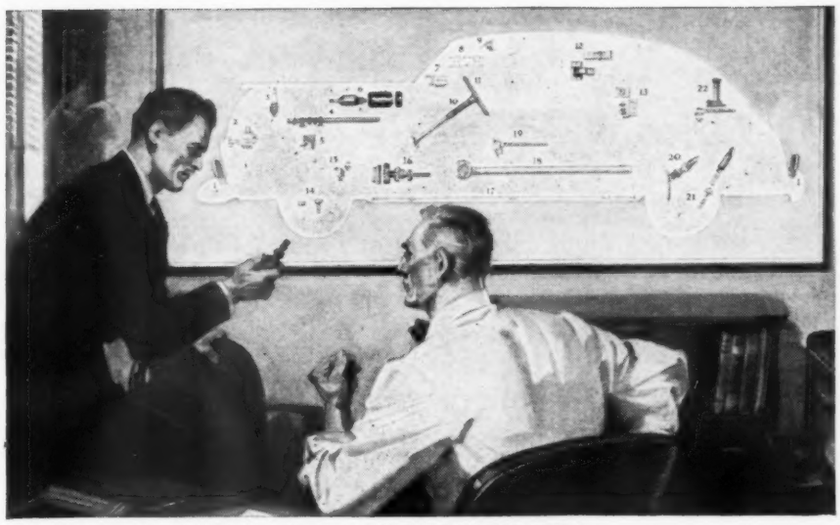
Ultra-Speed control (available in two sizes) permits combination of such units to accommodate as many welding guns as required for various assemblies. Each unit can be located close to the guns, and the welding transformer it controls, to reduce the size of the welding loop to minimum and provide maximum utilization of transformer capacity.

If required, units can be driven in tandem or at right angles through gears or flexible shafts. A single motor control with reversing switch and plugging stop synchronizes the operation of all units and prevents over-travel of carriages. One or more welding transformers can be used in connection with Ultra-Speed units to weld heavy sections.

Drive of the carriage is centered between three hardened and ground guides to assure smooth traverse. Carriage rolls have anti-friction bearings which carry both radial and thrust loads. Simple cams between the tappets actuate the contacts and assure complete opening of each welding circuit before the next circuit can be closed. Both the weld time range of all welding circuits and the maximum welding rate of the machine are increased. Engagement between contact blocks and feed bars is at an angle to the direction of contact block motion. This provides a self-cleaning, wiping contact over a large contact area. One-piece adjustable and removable feed bars on each side of the unit simplify resurfacing and adjustment when necessary. Dual equalizing-spring supports for the carriage rolls balance the contact pressure on both sides of the carriage. A pressure of 1100 psi. is used. The feed bar is watercooled, the circuit giving maximum cooling near the contact surfaces where most of the heat is generated. Contact blocks are connected to gun cables through laminated shunts. This prevents the transfer of cable kick to the contacts. Auxiliary springs assure quick return of contact blocks. The timing plunger and the parts comprising the contact mechanism are located in the same plane for each gun. This prevents overlapping of weld time of adjacent guns and eliminates dual-firing and burned contacts.



The Progressive control unit dispatches individually timed welding current to from 10 to 100 or more guns, each adjusted to its proper welding pressure. Welding rates up to 900 spots per min. are possible to speed the assembly of complicated parts in a single setup



DRAWN FOR JONES & LAUGHLIN STEEL CORPORATION BY ORISON MACPHERSON

FOR EASILY MACHINED, ACCURATE PARTS USE—
J&L COLD FINISHED STEEL

Your automobile is principally a product of steel—a family of steels made and finished in a variety of ways for the part each plays in giving you safe, fast, economical, dependable transportation.

Some parts are pressed. Others are forged. A great many stem from cold finished steel bars and shapes. Cold finishing of steel was discovered and developed at J&L. To this experience of the years has been added the quickening of research and production that the war demanded. Out of this now come new techniques and methods that promise profitable application in the peacetime manufacture of automobiles—of all manner of machines and equipment where strong, durable parts are needed.

The production of cold finished steel at J&L is integrated from raw materials to the hard, shining bars, the rounds, flats, hexagons and special shapes. Every step is controlled for quality. It is steel made to do the job, be it a gear in the water pump, the hard-working drive shaft or the special shapes that form the door hinges.

A few of the many uses of Cold Finished Steel in your car:

1. *Bumper guards—made from special shapes or ground bars.*
2. *Water-pump gear assembly.*
3. *Spark-plug parts.*
4. *Cold drawn tubing for rocker-arm shafts.*
5. *Piston pins.*
6. *Generator parts and shafts.*
7. *Control shafts on dashboard radios.*
8. *Speedometer gears.*
9. *J&L special precision ground stock for dashboard clock parts.*
10. *Steering column from cold drawn tubing.*
11. *Steering wheel hubs machined from cold drawn bars.*
12. *Door hinges from special shapes.*
13. *Door-lock and striker parts from special sections.*
14. *Nuts made from hexagon and special sections.*
15. *Grease and lubrication cups from cold drawn hexagons.*
16. *Transmission ring-gears made from special sections.*
17. *Running board treads molded in molds machined from cold rolled flats.*
18. *Drive shaft.*
19. *Seat adjuster rods.*
20. *Hydraulic brake connections and parts.*
21. *Shock-absorber parts.*
22. *Socket wrenches and jack (in tool kit).*

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH, PENNSYLVANIA

LIGHTER, STRONGER, CONTROLLED QUALITY STEELS

J&L STEEL

STEEL FOR MACHINES

Discouragement to autos was considered duty of many American municipalities when "horseless carriage" first appeared on streets, terrifying pedestrians. Ordinances put anti-speed humps in paving, forbade sale of gasoline, required drivers to send flagman ahead, compelled operators of steam propelled autos to become licensed engineers. Can you recall other similar restrictions?

1,500 makes of cars and trucks have been on market. How many do you remember?

Spark plugs in 1902 on Cadillac car were advertised as big feature because they could be taken off for cleaning "with the greatest of facility." Even then, as now, J&L cold finished steel was popular for spark plug shells.

Machines that make machines are called machine tools. They use cold finished steels in huge quantities to make other machinery and equipment and are themselves made of cold finished steel.

Organized in 1904, the SAE (Society of Automotive Engineers) brought about standardization of specifications that aided rapid development of motor cars.

Partial fabrication of parts is offered by special cold finished shapes in which J&L specializes, resulting not only in material and cost saving but in better physicals.

Before steel, machinery was laboriously, often clumsily, handmade of iron or even wood. The marvels of the present machine-tool age became possible when steel in abundance was made available in America about half a century ago.

Design engineers like new steels that are lighter, stronger, more workable and give them opportunities to re-design machines and equipment for greater usefulness at lower cost with less weight.

Gold medal for Jalcase Steel was awarded J&L at the Philadelphia Sesqui-Centennial Exposition. This grade was later adopted by SAE.

Bequests of iron nails, along with jewels, are found in wills of wealthy American Colonists because England forbade the Colonies to manufacture articles of iron.

Measuring to 5/10,000 of an inch with delicately balanced, jeweled gauges, so sensitive a watchmaker is employed to keep them accurate, has long been the practice at J&L in production of cold finished steel.

J&L Steel Data Chart, 29 x 45 inches, shows many tables (SAE, AISI, NE, and others) of tolerances, weights, hardness, machinability ratings, heat treatments, carburizing practice and spindle speeds for cold finished steel bars. For a copy write to Publicity Manager, Jones & Laughlin Steel Corporation, Pittsburgh, 30, Pa.

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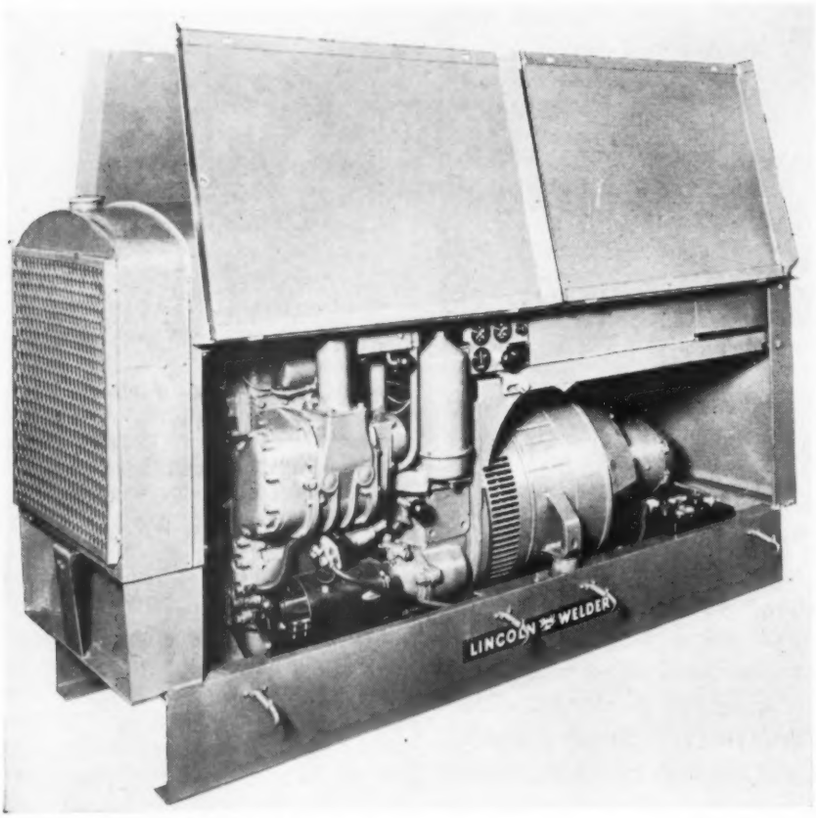
Lincoln Shield-Arc Generator Driven by 2-Cycle Diesel Engine



A diesel-driven welder of 300-amp. capacity for locations where electric power is not available, or not economical, is announced by the Lincoln Electric Co., Cleveland 1, Ohio.

The 2-cycle diesel has a simplified fuel arrangement with complete fuel-filtering system.

The welding generator has an NEMA rating of 300 amp. at 40 volts. Current range for welding duty is from 20 to 40 volts, 60 to 375 amp. The generator is a single-operator variable-voltage type, with complete laminated magnetic circuit and equipped with interpoles. It requires no external reactance or stabilizer. Dual control of welding current is accomplished by adjustment of both series and shunt fields. Supplies uniform welding current for metallic arc welding in any position with bare or heavily coated electrodes, also for carbon arc welding.

The generator control can be adjusted in continuous sequence steps by means of a shunt field rheostat. Current can be adjusted independently of open circuit voltage in continuous sequence by means of series field-current control. Combination of these controls permits operator to select any type of arc and any arc intensity to suit the job.

All control parts are in a steel cabinet; no current-carrying parts are exposed. Voltage and current controls, and polarity-reversing switch, are mounted on the dead-front panel of the control cabinet. A positive snap-action polarity-reversing switch indicates polarity on a dial.

The exciter and main welding generator are electrically separate to improve welding performance; the exciter being direct-connected to the commutator end of the generator armature. The exciter armature is mounted by sleeve construction on the shaft as the generator armature. The generator frame is attached to the engine bell housing and the generator shaft connected to the engine flywheel by flexible couplings.

A channel frame supports the entire unit. The pressed-steel canopy is supported by structural steel members. Side doors are hinged at top and provided with spring fasteners at bottom.

The Shield-Arc, 300-amp. welder (stationary model) weighs 2,560 lb. and can be mounted on wheels, trailer or truck. Optional equipment includes spring-mounted running gear of the automobile-trailer type with four pneumatic tires.

Clark Trucloader Fork Truck Maneuverable in Small Spaces

A lightweight fork truck manufactured by Clark Tructractor, 1938 Ezra St., Battle Creek, Mich., is designed to lift and tier unit loads weighing up to 1000 lb. and to operate within narrow limits. The Trucloader is suitable for loading and unloading highway trucks and trailers. It is maneuverable in narrow aisles and has a turning radius of 57 in. With its light weight, it will run safely in and out of trucks and trailers and can be used in elevators which cannot handle heavier units.

The short wheelbase allows the truck to negotiate steep grades between platforms and tailboards.

Specific benefits achieved by the Trucloader are a saving of manhours required for loading and unloading; reduction of losses from breakage; reduction of idle time of trucks

NEW!

Barnaby INSIDE ADJUSTABLE GAGES

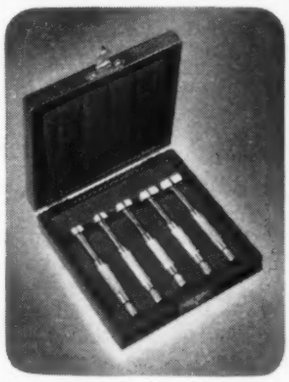
For Toolroom, Inspection or Production Department Use!

These NEW adjustable plug gages are exceptionally useful, both for inspection of inside diameters and for checking bell-mouth and out-of-roundness. Eight standard gages cover all sizes from .375″ to 1.500″, and others can be furnished on special order.

Adjustment is obtained by turning the knurled end-piece, which actuates the one-piece collet-type head to open or close the split anvil. The gage is set by micrometer or master gage and the adjustment is held securely. All working parts are of hardened alloy steel, precision-finished throughout and hard chrome plated for extra-long life.

SUPPLIED IN COMPLETE SETS

The standard set of five gages covers a range of .500″ to 1.000″ in .100″ increments and is furnished in a serviceable leatherette-covered case. Three additional standard gages are available for ranges of .375″ to .500″, 1.000″ to 1.250″ and 1.250″ to 1.500″. All gages can be purchased individually if desired.



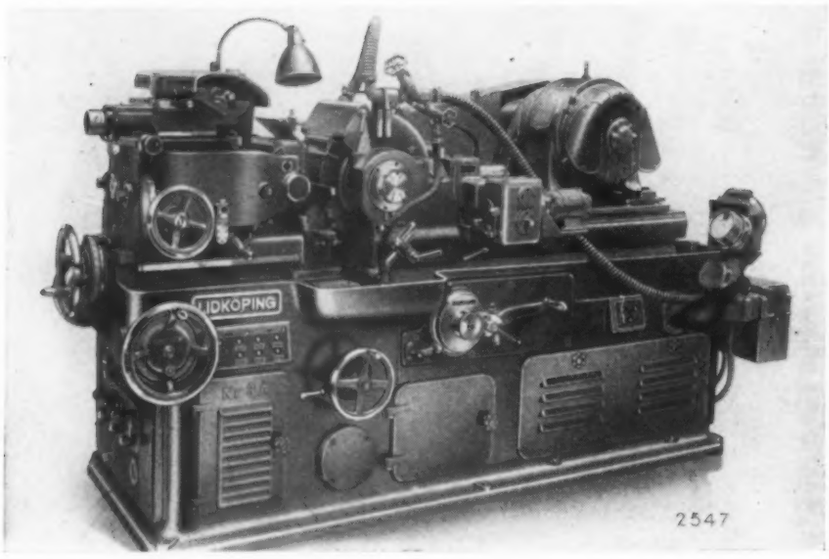
These NEW precision tools offer worth-while savings in both gaging time and reduced gage inventory. Write today for full information.

TRADE MARK REG. U. S. PAT. OFF.

BETTER Barnaby TOOLS

BARNABY MANUFACTURING and TOOL COMPANY

70 KNOWLTON STREET - - - BRIDGEPORT 8, CONNECTICUT



Heavy construction and bearings for spindles on both sides feature this Swedish centerless grinder

Lidkoping Centerless Grinders Remove 100 lb. Metal per Hour

Lidkoping Mekaniska Verkstads A. B., a division of SKF Ball Bearings, Sweden, manufactures the centerless grinding machine announced by Triplex Machine Tool Corp., 127 Barclay St., New York 7, N. Y. Lidkoping centerless grinders are of heavy construction and have both grinding- and regulating-wheel spindles supported by bearings on both sides. Because of this rigidity, machines are capable of high accuracy. A through-feed speed of 100 fpm. and stock removal of 100 lb. per hr. have been obtained in grinding steel shafts. Lidkoping grinders can be used for through-feed and for in-feed grinding. Both wheels are provided with adjustment relative to the work. A variety of attachments is available for profile grinding, feeding of short pieces, grinding of bars, tubes and twist drills.

Horsepower rating of the grinding-spindle drive motor on the No. 3A machine is 15 hp. 25 hp. on the No. 4A, 50 hp. on the No. 5A and 90 hp. on the No. 64 grinder. Grinding-wheel sizes range from 16-in. dia. x 6¾-in. width to 30-in. dia. x 16-in. width.

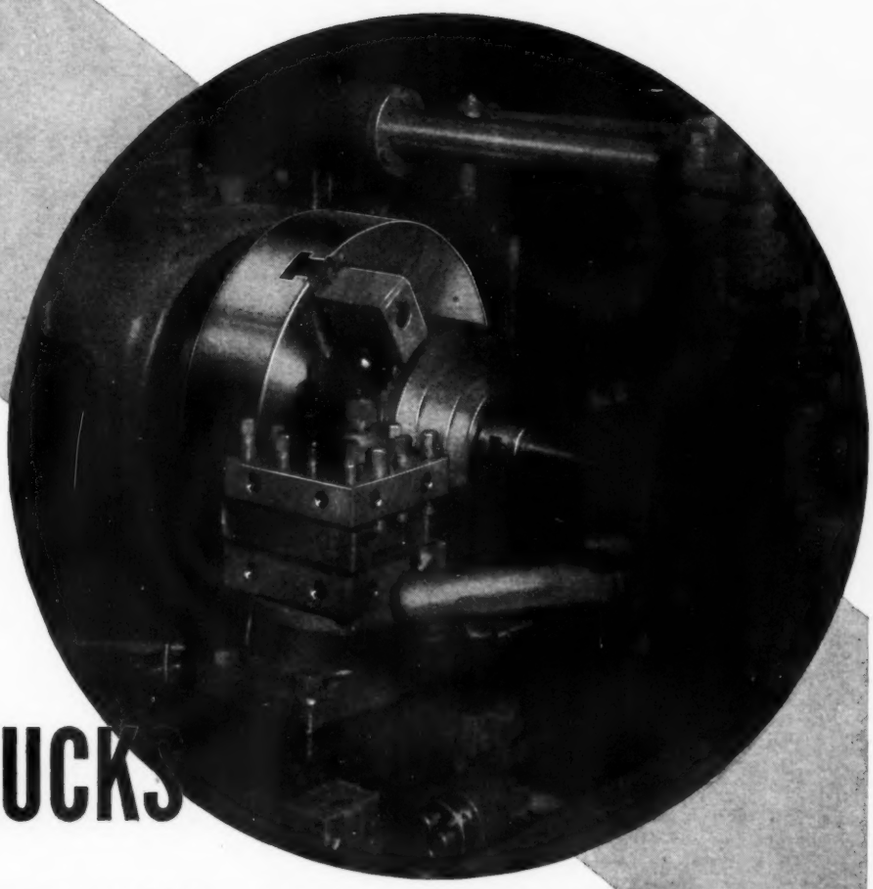
Producto-Check Gage Components Assemble in Various Combinations

Producto-Check is designed for production checking and is manufactured by the Gage Div., DoALL Co., Minneapolis, Minn. It consists of a number of instruments to be used in conjunction with gage blocks for setting up any type of inspection gage. Dial-indicating snap gages, plain bench comparators, dual bench comparators, angle comparators, square comparators, precision height gages, depth gages and a series of go-no-go snap gages of any size up to 18 in. can be made up of components in the set. Plug gages and internal gages of any size in steps of 0.001 in. can be made up. In addition, gages such as hole, hole to base, parallel bore gages, pitch diameter, and others can be made up for special applications. A set of holders from 2 to 18 in. long are designed to carry the gage blocks. Besides the hand-held gages that can be formed, a series of bench and surface-plate gages can be assembled by using the base block, master flat or other attachments. In addition to the usual types of gages, there are several unusual ones. One of these is an indicating snap gage incorporating a dial indicator. Another is an internal gage incorporating a dial indicator. Then there is an angle comparator using two dial indicators, which is set with a sine bar. When an angle identical to that of the sine-bar setup is checked, the dials read alike. Included also in the kit is a multiple bench comparator that makes two measurements simultaneously, permitting increased speed in production checking.

Another instrument of the kit is an indicating-square check gage. With this, the work is placed on a master flat and is simply pushed against a back stop; a dial indicator showing instantly whether or not the angle is 90°. A set of wires of various diameters are lapped to the accuracy of gage blocks and are used direct as plug gages or in caliper jaws where square jaws could not function.

Although it is used in conjunction with gage blocks and in some cases a surface plate, the kit itself does not include these items

• POWER
• PRECISION
• SPEED



GOOD CHUCKS

ARE ESSENTIAL TO LOW COST PRODUCTION

POWER to take fast, heavy cuts...to turn a hot chip that makes the coolant smoke...

PRECISION that holds each one of a million work-pieces in exactly the same relation to the tool...and cuts down your percentage of rejects...

SPEED that gets a finished work-piece *out* of the chuck and a rough one *in,* in a matter of seconds...

These three factors are built into Cushman Chucks.

Before you decide on chuck equipment for those new machines, consult the Cushman engineers; they can provide special work-holding devices that will help you toward high accuracy, high volume production at low unit costs. Consult us on any work-holding problem.

THE CUSHMAN CHUCK CO.
HARTFORD 2, CONN.

A WORLD STANDARD FOR PRECISION

CUSHMAN CHUCKS

Parts and Materials

Stack-O-Meter Indicates CO_2, Stack and Draft Readings

Davis Emergency Equipment Co., Inc., 45 Halleck St., Newark 4, N. J., announces a portable instrument, the Stack-O-Meter, for indicating CO_2, stack temperature and draft readings.

All readings are taken on one meter. CO_2 percentage readings are obtained from gas samples collected through a hand aspirator bulb. Stack temperatures are read on the same dial, obtained electrically from a thermocouple mounted in the gas sampling tube. Draft measurement is obtained through a separate tube, but read on the same meter.

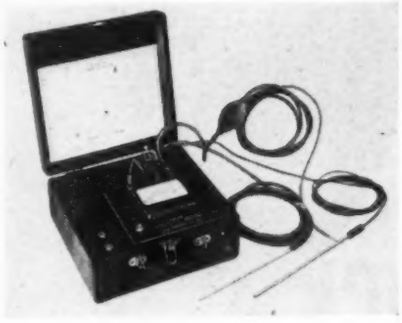
The meter dial reads 0 to 20% CO_2 in black figures, temperature on a red scale 0 to 1000 F. and draft in tenths of inches of water on a green scale.

A safety switch automatically shuts off battery current on closing the cover of the instrument box.

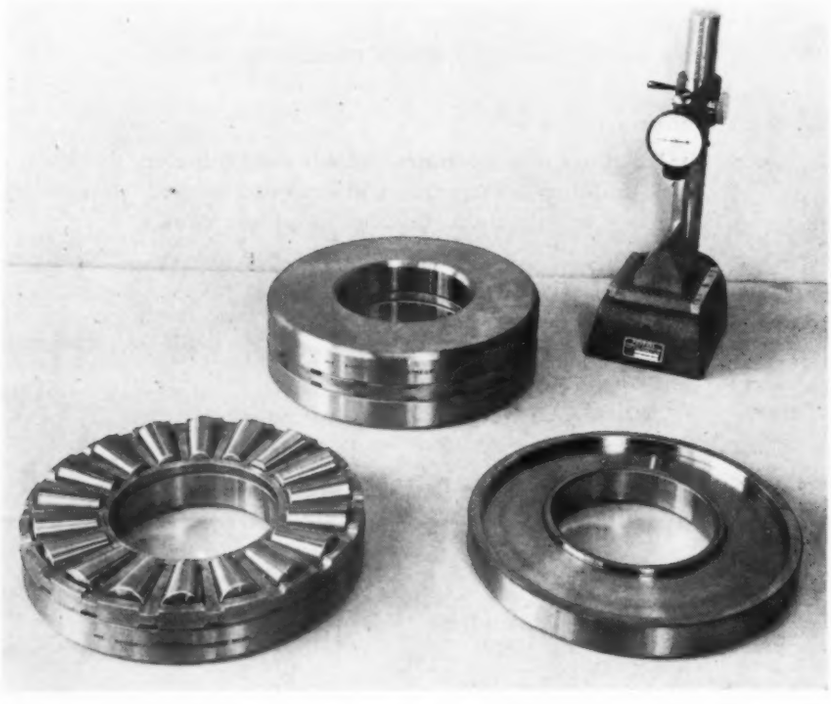
Complete portability is obtained by having sampling hose, hand aspirator, thermocouple sampling and draft sampling tubes all in the one case, 12 x 13 x 5 in. Weight is 11 lb.

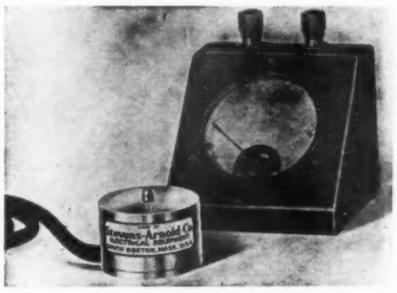
Electrically operated, the only maintenance is that of replacement of batteries, which are of the standard flashlight type.

Accuracy of the Stack-o-Meter is based on the thermal conductivity principle of analyzing gases by means of a wheatstone-bridge circuit.



The Stack-O-Meter is designed for use wherever there is a need for a portable instrument for analysis of combustion. Rugged in its construction, it can be conveniently carried by hand or auto without danger of breakage, spilling or freezing of liquid





The pick-up may be used under unfavorable operating conditions, including heavy vibration, at temperatures up to 300 F., and, because it is hermetically sealed, it may be submerged in water. Power supply may be 115 volts ac. or an 8-, 18- or 24-volt battery. Results may be recorded on a continuous strip chart

Stevens-Arnold Deflection Pick-Up Hermetically Sealed

The deflection pick-up manufactured by Stevens-Arnold Co., 22 Elkins St., S. Boston, Mass., is an hermetically sealed electrical unit which translates minute deflections or pressure variations, applied to its plunger, into linear changes in its dc. output voltage.

Kaydon Conical-Roller Bearing Carries Heavy Thrust Loads

Kaydon Engineering Corp., Muskegon, Mich., announces a conical-roller thrust design to supplement the straight-roller type of thrust bearing. This bearing design is such that the apex of the cone formed by the rollers meets at the true center of the bearing. This permits the rollers to align themselves between the tapered faces and the outside rib of the raceways.

High speeds are easily handled by this type of bearing. Conical-roller thrust bearings are designed to carry thrust loads only. Mounting should be designed to avoid radial load.

Conical-roller thrust bearings from 9⅞ in. O.D. to 19½ in. O.D. and load capacity up to 440,000 lb. are made by Kaydon Engineering

FASTER Machining PLUS Freedom From TROUBLE

WITH X1515 AND X1545

SPEED CASE SPEED TREAT

OPEN HEARTH

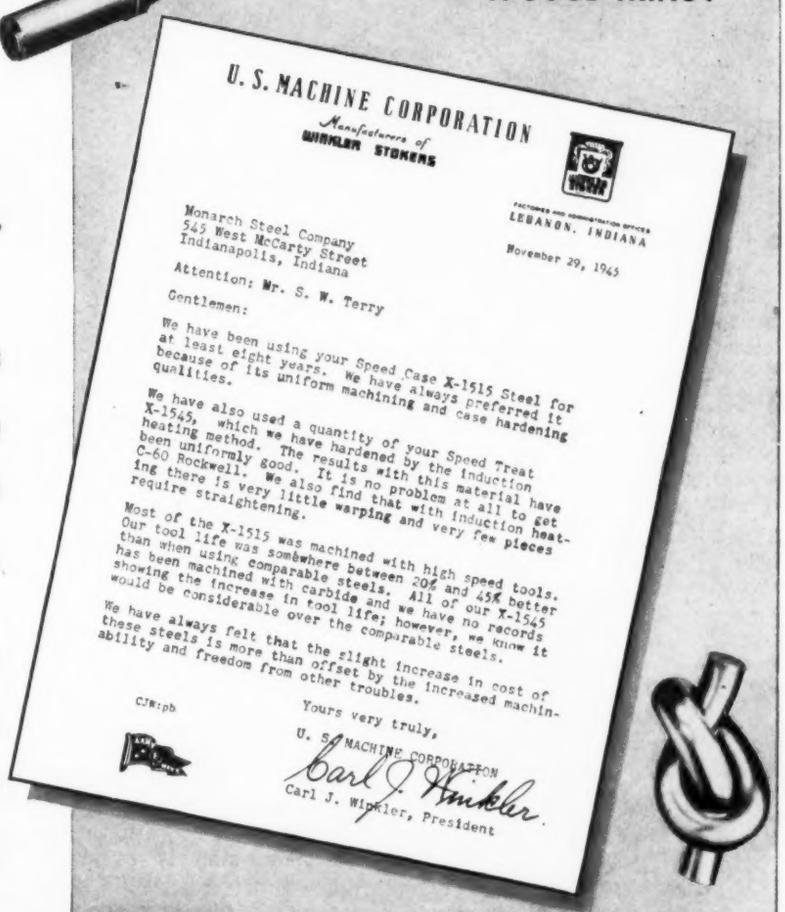
STEELS

HAVE YOU BEEN MISSING A GOOD THING?

U. S. MACHINE CORP. SAYS:—

Used X1515 Speed Case Steel for 8 years because of uniform machining and case hardening. High Speed TOOL Life increased 20% to 40%.

SPEED TREAT X1545 induction hardened with uniform results, little warping and increased Tool life even when machined with carbide.



U. S. MACHINE CORPORATION
Manufacturers of
WINKLER STOKERS

FACTORIES AND ADMINISTRATION OFFICES
LEBANON, INDIANA

November 29, 1945

Monarch Steel Company
545 West McCarty Street
Indianapolis, Indiana

Attention: Mr. S. W. Terry

Gentlemen:

We have been using your Speed Case X-1515 Steel for at least eight years. We have always preferred it because of its uniform machining and case hardening qualities.

We have also used a quantity of your Speed Treat X-1545, which we have hardened by the induction heating method. The results with this material have been uniformly good. It is no problem at all to get C-60 Rockwell. We also find that with induction heating there is very little warping and very few pieces require straightening.

Most of the X-1515 was machined with high speed tools. Our tool life was somewhere between 20% and 45% better than when using comparable steels. All of our X-1545 has been machined with carbide and we have no records showing the increase in tool life; however, we know it would be considerable over the comparable steels.

We have always felt that the slight increase in cost of these steels is more than offset by the increased machinability and freedom from other troubles.

Yours very truly,

U. S. MACHINE CORPORATION

Carl J. Winkler

Carl J. Winkler, President

CJW:pb

TEAR THIS OFF

Licensor
MONARCH STEEL COMPANY
HAMMOND · INDIANAPOLIS · CHICAGO
PECKOVER'S LTD., Toronto, Canadian Distributor

MANUFACTURERS OF COLD FINISHED CARBON AND ALLOY STEEL BARS

Licensee for Eastern States
THE FITZSIMONS COMPANY
YOUNGSTOWN, OHIO

PASTE ON YOUR LETTERHEAD AND

MAIL IT IN

FOR

SPEED CASE—SPEED TREAT

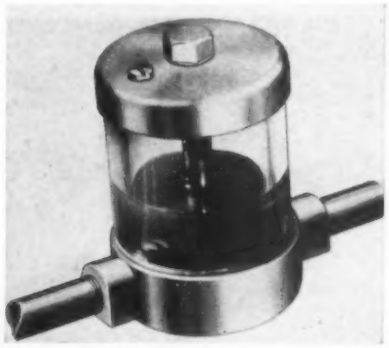
CATALOG

CCA Pneumatic Tool Lubricator Supplies Regulated Oil Mist

Designed for automatic lubrication of pneumatic equipment, the CCA Lube is announced by CCA Products Engineering, Box 671, Glendale, Calif. Features of the CCA Lube include a transparent plastic window with O rings for top and bottom seals. Quantity of oil in the lubricator is visible at all times. Regulation of lubricant is accomplished by a needle valve on the air outlet side. This regulator is adjustable to meet varying equipment requirements. The filler cap and adjusting aperture is located directly above the regulator valve. As the Lube works only when air operated equipment is in use, the device is fully automatic, permitting only the correct amount of oil to mix with working air.

Its output is 75 millivolts and its internal resistance less than 1 ohm; it may be connected directly to standard indicating instruments of a type that are rugged, inexpensive and portable. Several pick-ups may be connected together in parallel.

The combination of a pick-up and an indicating voltmeter gives the following results and remote indications are obtained at any distance: electric micrometer range 0.001 to 0.1 in.; electrical measurements of force, acceleration and pressure; electric deflection gage.



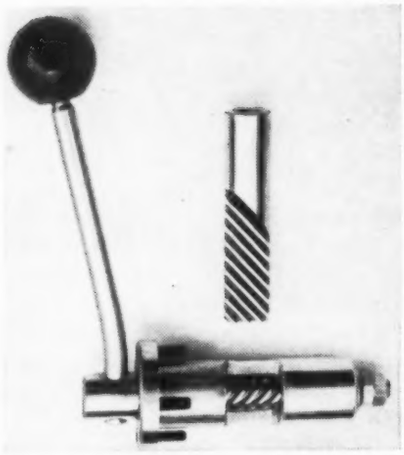
Full adjustability of the Lube prevents oil flooding as well as oil starvation, and eliminates freezing of pneumatic equipment. The needle valve can be turned off altogether in cases where no lubrication is required

Cone-Lok Clamp and Clamp Unit Suitable for Fixture Applications

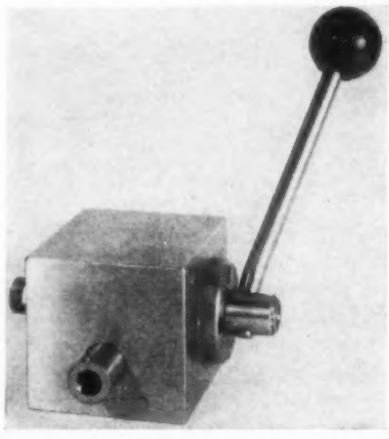
The Cone-Lok fixture clamp and the Cone-Lok unit are announced by the N. A. Woodworth Co., Ferndale, Mich. The fixture clamp is a self-contained clamp that is applicable to the majority of clamping operations. Manufactured in three sizes, it employs a mechanism which consists of male cones formed on the pinion shaft and which fit closely with female cones integral with the housing. A normal amount of wear on the cones has no ill effects on the efficiency of the lock and results in increased efficiency.

Movement of the plunger is possible only by action of the operating lever. Work is positively clamped at any location in the stroke of the plunger. Severe chatter, from heavy milling cuts, fails to loosen the clamp.

The Cone-Lok unit is also manufactured in three standard sizes. The unit consists of rack, pinion, bushing and lever and is intended for the purpose of adaption to fixtures and machines of special design.



To apply the unit it is necessary to bore two straight holes through the jig or fixture, insert the rack plunger in one hole and the bushing in the other. The bushing is locked in place by four socket-head capscrews



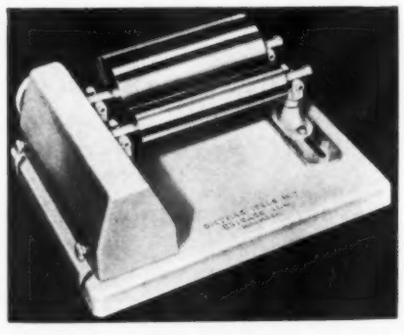
Plunger travel on the small size is 3/4 in., on the medium size 1 1/32 in. and on the large size 1 3/4 in. with 180° travel of the operating lever

Spitfire Roller Lap Machine Improves Lapping Quality

The roller lapping machine manufactured by Spitfire Tools Inc., 2930 N. Pulaski Rd., Chicago 41, Ill., consists of two precision-ground cast-iron rollers which revolve in self-aligning bearings. One roller is 3 in. dia. x 12 in. long and the other is 6 in. dia. x 12 in. long. Both rollers rotate in the same direction at the same speed. They are adjustable to accommodate work up to 6 in. in dia.

Abrasive compound is placed on the rollers and spread evenly over both surfaces. The work is placed between the rollers; then a notched fiber stick is pressed on it and slowly moved from side to side across the plug or pin. If it is necessary to lap a small amount off any particular section, the fiber stick is kept longer on that section. Friction of the rollers on the plug causes it to revolve, and the difference in the surface speed of the rollers brings about a lapping or polishing action. Tapered plugs or plugs with shoulders are handled with ease. Waves and high spots are removed from the length of the plug or rod due to the line contact of the work and the rollers.

With this method, no chucks are used. The work may be put in and taken out for checking and measurement without stopping the machine. As excessive heat is dissipated by the large mass of the rollers, a cooling period is not necessary and dimensional changes due to temperative variation are eliminated.



Line contact of the Spitfire roller lapping machine prevents irregularities in lapped diameter. The large mass of the rollers dissipates heat quickly and eliminates cooling periods. End clearance at the rollers permits parts with shoulders or on projections to be lapped up to the projection. Tapered pins, difficult to lap with ring laps, are lapped as easily as straight pins

THIS Sheffield Precisionaire which reminded the purchaser of a piccolo, checks a tapered bore at ten points. Inside the spindle a plunger type valve directs the air flow through one pair of diametrically opposed orifices at a time, thus making it possible to check each of the ten points in sequence.

The tolerance markers on the base instrument are set to the maximum and minimum master chambers (illustrated). In inspecting the work part the spindle is inserted into the bore and each of the ten points checked progressively. If the indicator remains within the length of tube between the markers throughout the inspection, the part is acceptable. If not, any error is immediately located.

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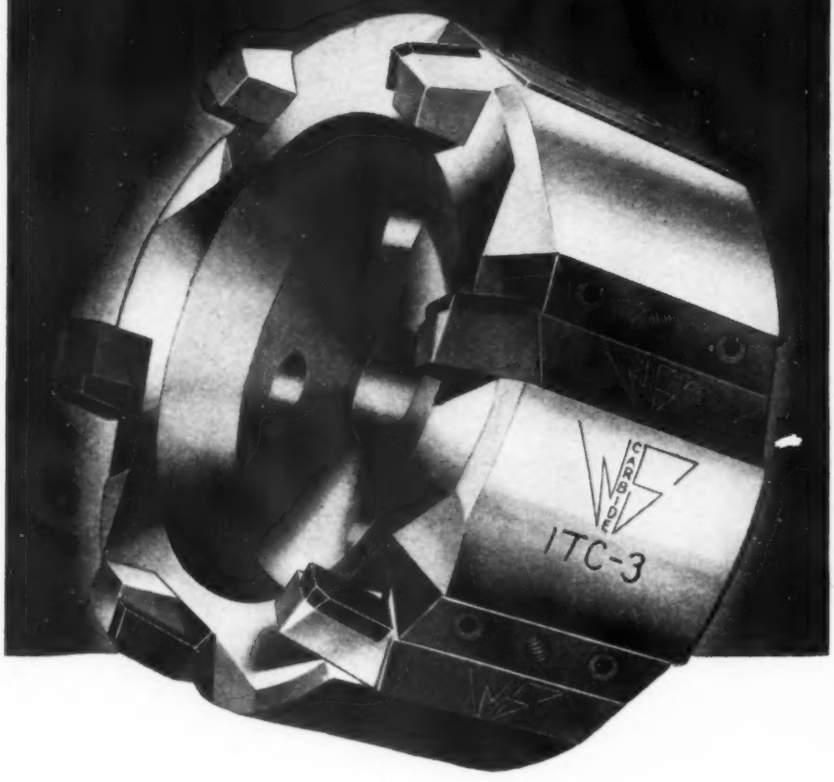

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TO THE EDITOR

SHOP GETS OLD TOOLS

The disposition of old tools is basically a problem of costs, to be decided by investigations of the engineer and cost accountant. Business men, like all persons, are not always rational and have the "it's good enough" attitude. The object of production is profit and not sentimental attachment to tools, old or new.

The decision is partially based on the output of a new tool compared to that of an old one, or the comparative output of an old toool in a different job. Obviously, when an old tool can maintain the same rate of output and quality as a new tool, the tool need not be replaced or diverted. Condition, not age, is the deciding factor.

In manufacturing, the basic production unit is the toolroom where machine tools do jobs of varying accuracy, size, and kind. Toolroom equipment must in many cases be in the best of condition to handle diversified tasks. Obviously, the manufacturer hesitates to install new equipment in the toolroom because tools usable nowhere else are idle. However, a well-planned and properly managed toolroom has a minimum number of idle tools.

A tool to be used in production need not be in the best condition to do various jobs, but can be used for one-purpose jobs where jigs and fixtures are permanent attachments. As an example, a lathe with a broken compound and a defective leadscrew could be used for straight turning production, but not for accurate thread cutting or cutting angles. Or a defective leadscrew on a milling machine would necessitate repairs for general use. In production, stops could be used, but for general work the screw is needed for locations.

An old tool may be satisfactory for "roughing" or for work where accuracy is not especially essential. This is often the case with products where replacement parts are seldom needed in volume or standard dimensions. A new tool would almost never be used for jobs where attachable grinders or other destructive attachments are employed. An old tool with jigs and fixtures attached may be used for seasonal or uncertain outputs when the cost of "setting up" is great. Modern tools have quick change of speed and feed. These devices are not needed for one-purpose tools.

Obsolescence may prohibit a machine for production use, but it may

ROTARY FILES—especially when driven through flexible shafting—enable filing operations in hard-to-get-at places . . . in grooves, cups, corners, deep or irregular slots, under ledges, behind offsets, through narrow necks, for example.

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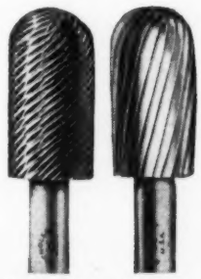

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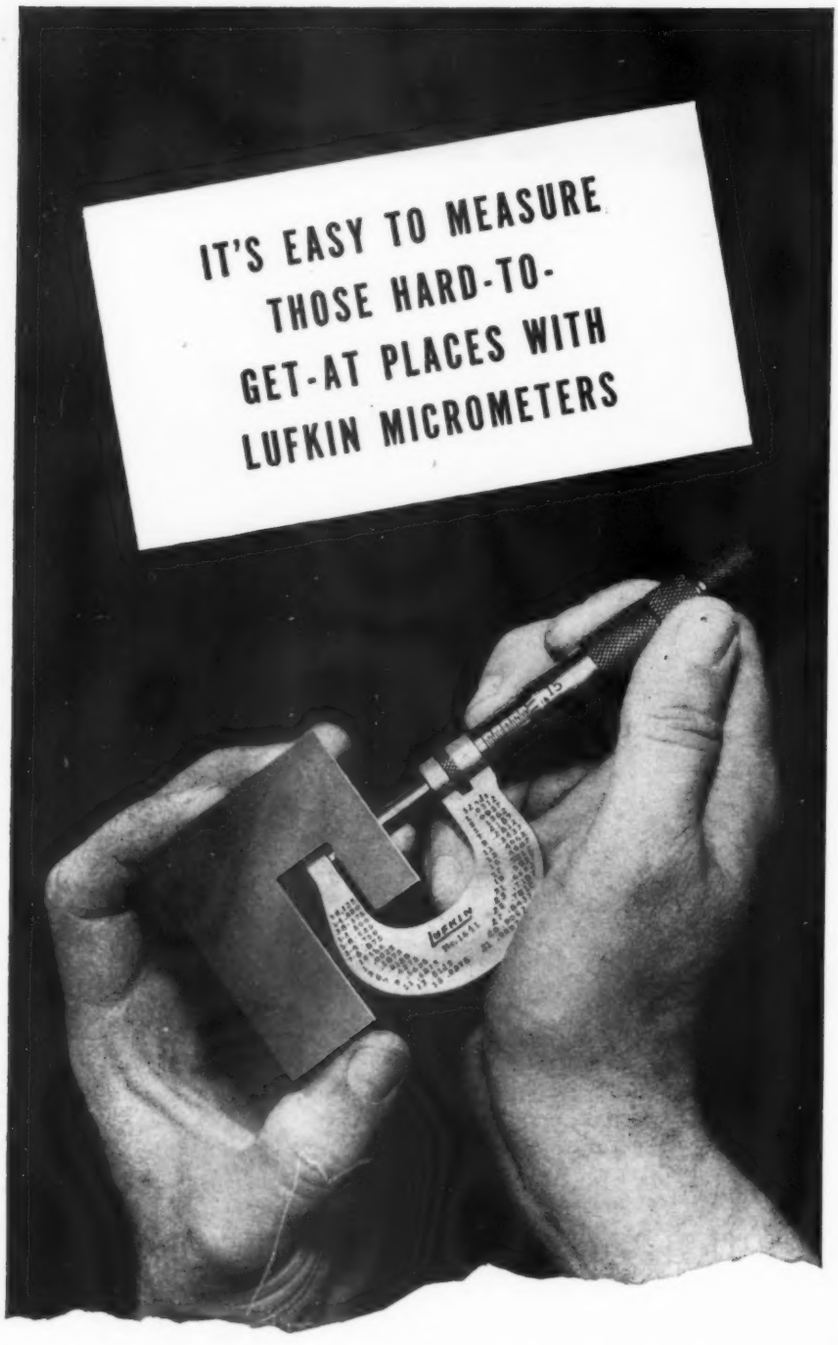

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be satisfactory for odd jobs, such as in the maintenance department or the toolroom.

To a small manufacturer especially, the expenditure for a new tool may be a problem of finance more than a problem of minimizing production costs. Even if a new tool would reduce cost or increase quality and rate of output, financial conditions may prohibit an expenditure of funds.

The accountant must determine and apply the relative cost of maintenance of a new tool and an old tool. Any decision should be based on rational study of company financial condition, product, and the rate and quality of output of the manufacturer.

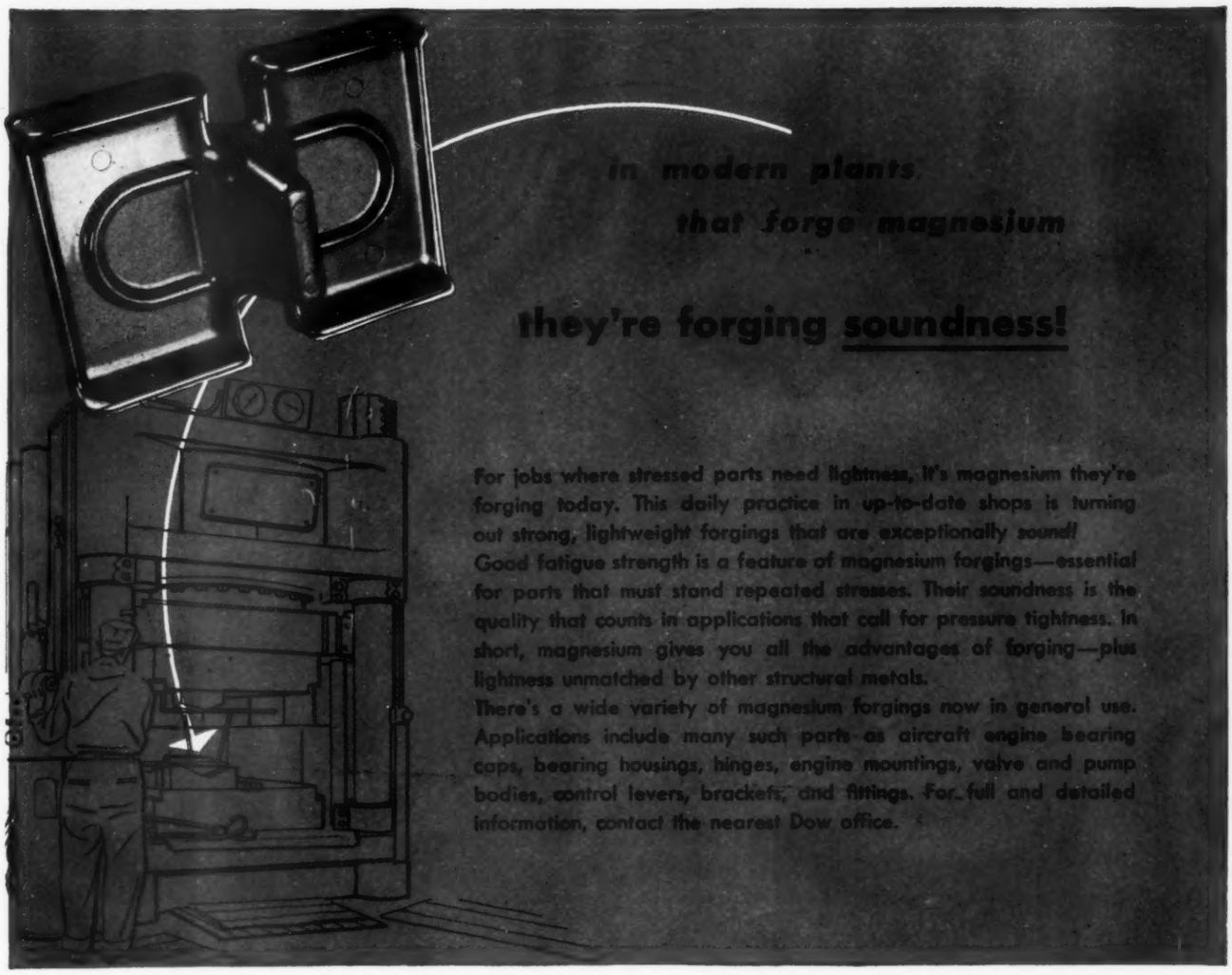
Robert E. Olsen
Chicago 21, Illinois

YOUNG MEN AND OLD TOOLS

We are living in a modern industrial era that grows with inventions. The two characters in your Round Table discussion on used tools have not analyzed all the facts. Old machines are needed not by the established factory but by enterprising young men. A fellow starting his own business does not have the necessary starting capital to finance a decent layout. The modern shop can sell its machines. This makes a cycle of buying and selling and keeps people working. Modern equipment means that designers are working. It also means that we are progressing with our inventions—in other words we are having prosperity.

The fundamental principle of running a machine is simple. To remove stock from a piece of work, you turn the dial on the machine a certain amount and that is all. This is simple, when the machine is in perfect working order, but it changes the operation considerably when the machine is not in perfect order. You turn the dial, hoping it will take an equivalent amount of stock off. Old machines have worn feedscrews. This causes, many hit-and-miss operations. Have you ever tried to do precision grinding on a worn grinder? I believe you could do it, but how long would it take you and how sure would you be of getting the right size? A micrometer is good as long as it measures in thousandths and your tolerance is plus or minus 1/64. How good is it when working with tenths?

Keeping machines for rougher operations is no different than keeping a lathe made in 1900 for polishing. You can always find some odd operation for old machines. Old machines can be sent to small technical schools that have no machines. The very old ma-



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that forge magnesium

they're forging soundness!

For jobs where stressed parts need lightness, it's magnesium they're forging today. This daily practice in up-to-date shops is turning out strong, lightweight forgings that are exceptionally sound!

Good fatigue strength is a feature of magnesium forgings—essential for parts that must stand repeated stresses. Their soundness is the quality that counts in applications that call for pressure tightness. In short, magnesium gives you all the advantages of forging—plus lightness unmatched by other structural metals.

There's a wide variety of magnesium forgings now in general use. Applications include many such parts as aircraft engine bearing caps, bearing housings, hinges, engine mountings, valve and pump bodies, control levers, brackets, and fittings. For full and detailed information, contact the nearest Dow office.

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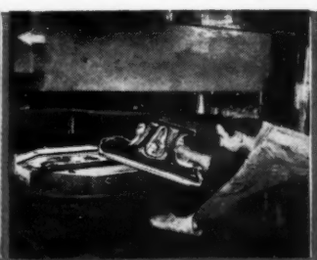
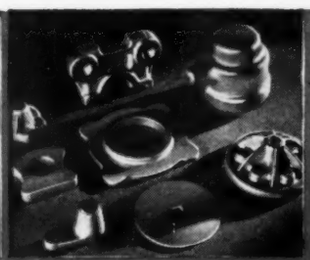
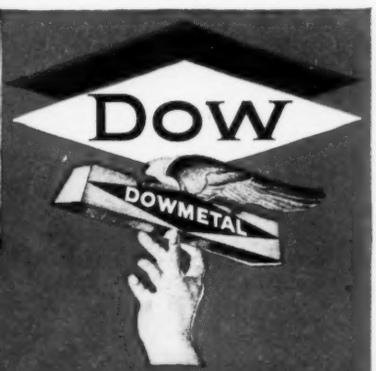


Modern facilities for forging magnesium are available in Dow's shops and those of many independent fabricators.



Magnesium forgings of many kinds are finding successful application in diversified fields where lightness is a factor.



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chines can go to a museum. There is always some place that you can put an old machine.

Would not the cost of machines decrease when modern inventions are applied to new machines? Where would our automobile industry be if everyone kept his old automobile? A few extra dollars spent on a new machine starts a cycle of prosperity.

Walter Dimitruk
New York 9, N. Y.

TOOLROOM SHOULD HAVE THE NEW

The subject "Where Should Company Used Tools Go?" in a recent Round Table certainly is the basis for much interdepartmental controversy. In the first place it is human nature for a department head to resent having to accept a secondhand machine from another department when he knows the other department is to receive a new machine.

However, personal feelings in such matters must be tactfully cast aside and decisions rendered as to who gets the new machine on a purely factual basis.

Generally speaking, the toolroom has no further use for a machine tool which has lost its versatility. By that is meant that it takes a toolmaker too long to set up and produce a satisfactory job. Before considering placing in the production line a machine tool which has lost its usefulness in the toolroom, a thorough investigation should be made of the operation or operations contemplated in order to determine if the used machine can produce the parts at a cost comparable to new-equipment performance. Cost per piece is the determining factor when it becomes necessary to decide whether a used or new machine is to be used.

From experience and observation I have found that it sometimes pays dividends to recondition and put in operation newer-model machine tools which are in poor condition than to use the older tools which were apparently in excellent mechanical condition, because of the wider differential in production performances of the newer equipment.

What to do with used machine tools becomes a matter of economics and not tradition. All things being equal, if a machine tool being used in the toolroom can do the job economically on a production line, then the toolroom should be given the new equipment, because I believe it will be given better care there.

Peter L. Budwitz
Meriden, Conn.

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The Kalamazoo has this and OTHER EXCLUSIVE FEATURES for safe, easy operation—and maximum speed and production on 90 per cent of all cutoff work.

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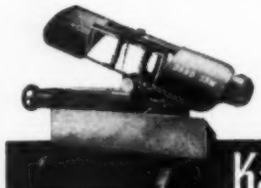

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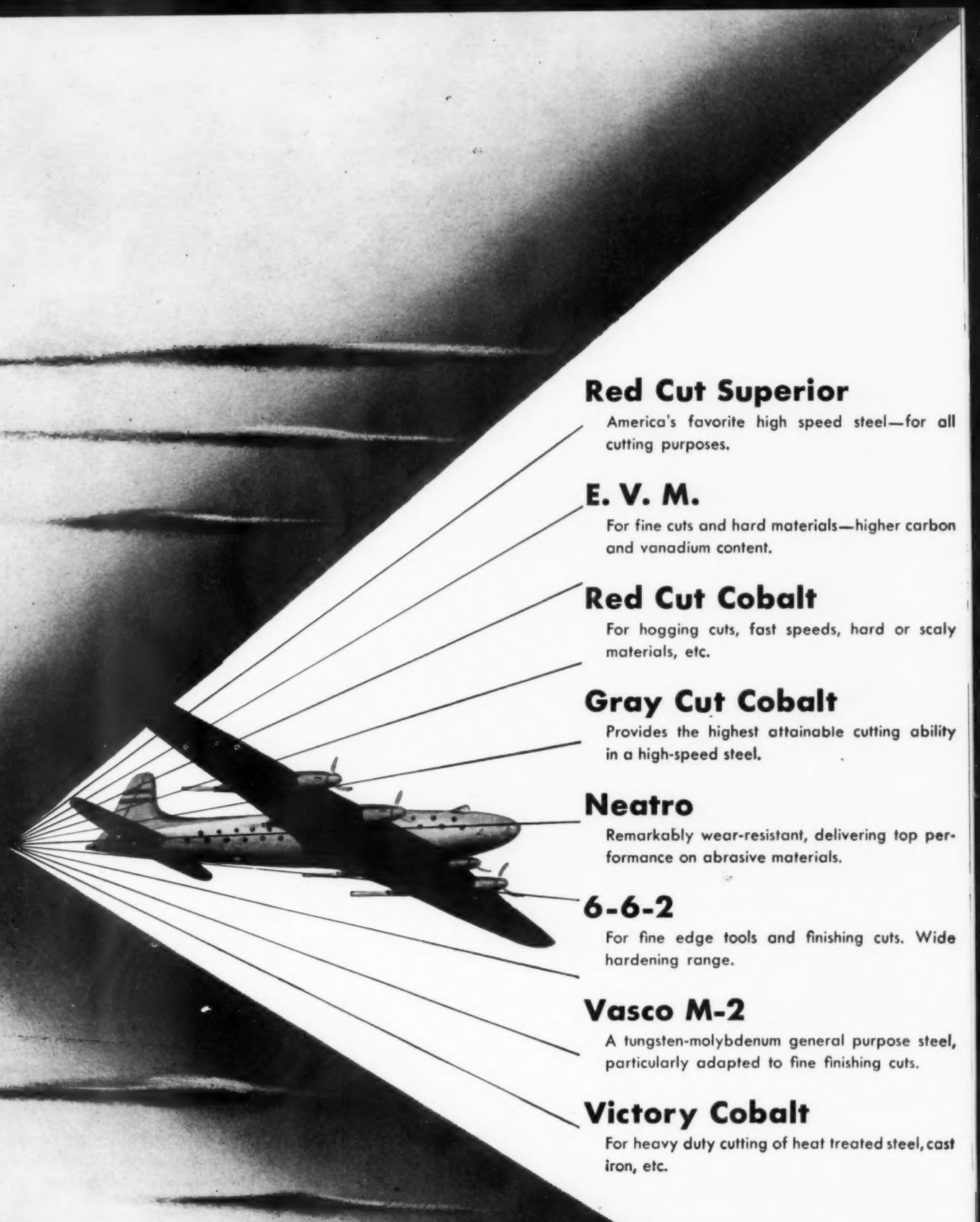

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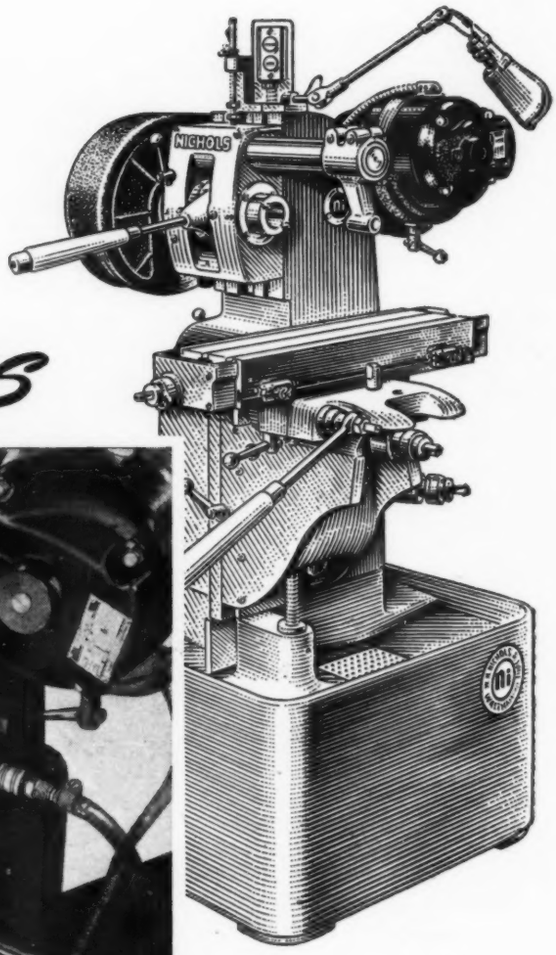

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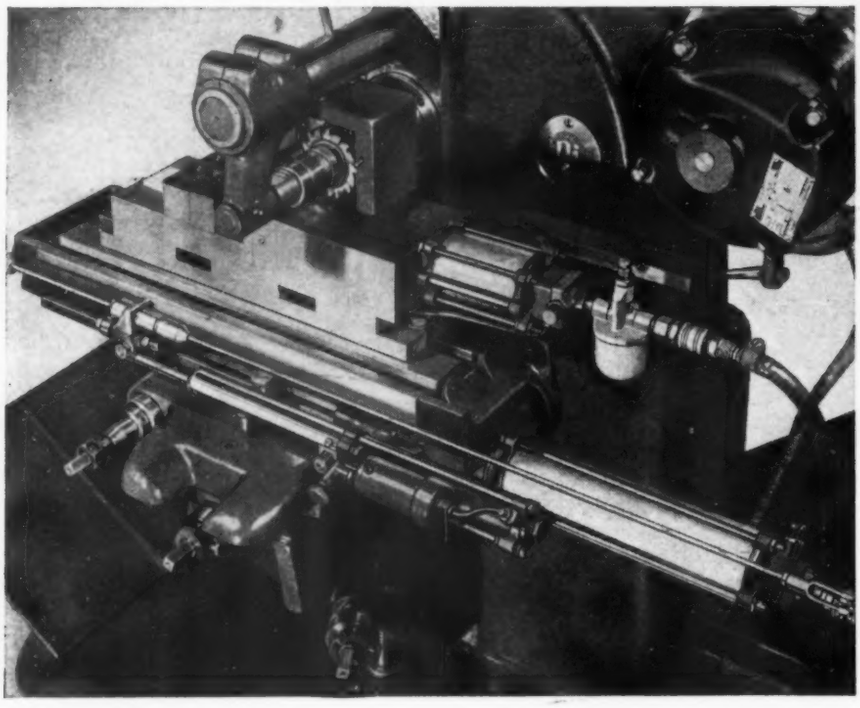

Photo shows Nichols power feed attachment installed. In this case, work is held in an air-operated vise

a *Power* feed attachment for any *Nichols* Miller

Here is a tested and proved power feed attachment that is an added production asset for *any* Nichols Miller. It is designed to reduce the time of the operating cycle and reduce the operator's duties so that often one operator can run two or more machines.

This power feed attachment is designed for fast table advance — maximum proper cutting feed — fast table reverse—automatic shut-off. It is completely automatic except for loading and unloading the work. Rapid traverse and work speeds are easily and quickly changed to suit all classes of jobs within the capacity of the machine.

Basically this attachment is a Bellows air feed unit used in conjunction with a Hydro-Check. Thus a positive, infinitely variable feed is obtained throughout the 9" maximum cutting stroke by using regular shop air lines with 75 to 175 lbs. pressure.

The Nichols power feed attachment can be installed either before or after shipment of the Nichols Miller. *It can be installed quickly on any Nichols Miller ever built.* Write for details.

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The Black & Decker Portable Electric Sander is more than a Sander! It's also a Grinder . . . a Wire Brusher . . . a Planer . . . a Surfacer. It drives a wide variety of attachments to make quick work of a tremendous variety of jobs.

With abrasive discs in 19 different grains, it sands and finishes any surface. With Wire Cup Brushes, it takes off old paint, rust and scale . . . cleans castings, tanks, boilers, vats, sheet metal and soldered joints. With saucer or cup-type grinding wheels, it removes metal . . . smooths welds and casting ridges . . . grinds off old rivets, studs and bolts . . . sharpens stationary machine blades often better than a Portable Grinder. With rotary gouging and planing heads, it shapes and semi-finishes lumber, removes stencil and brand marks from barrels and boxes . . . faster, cleaner, more uniformly.

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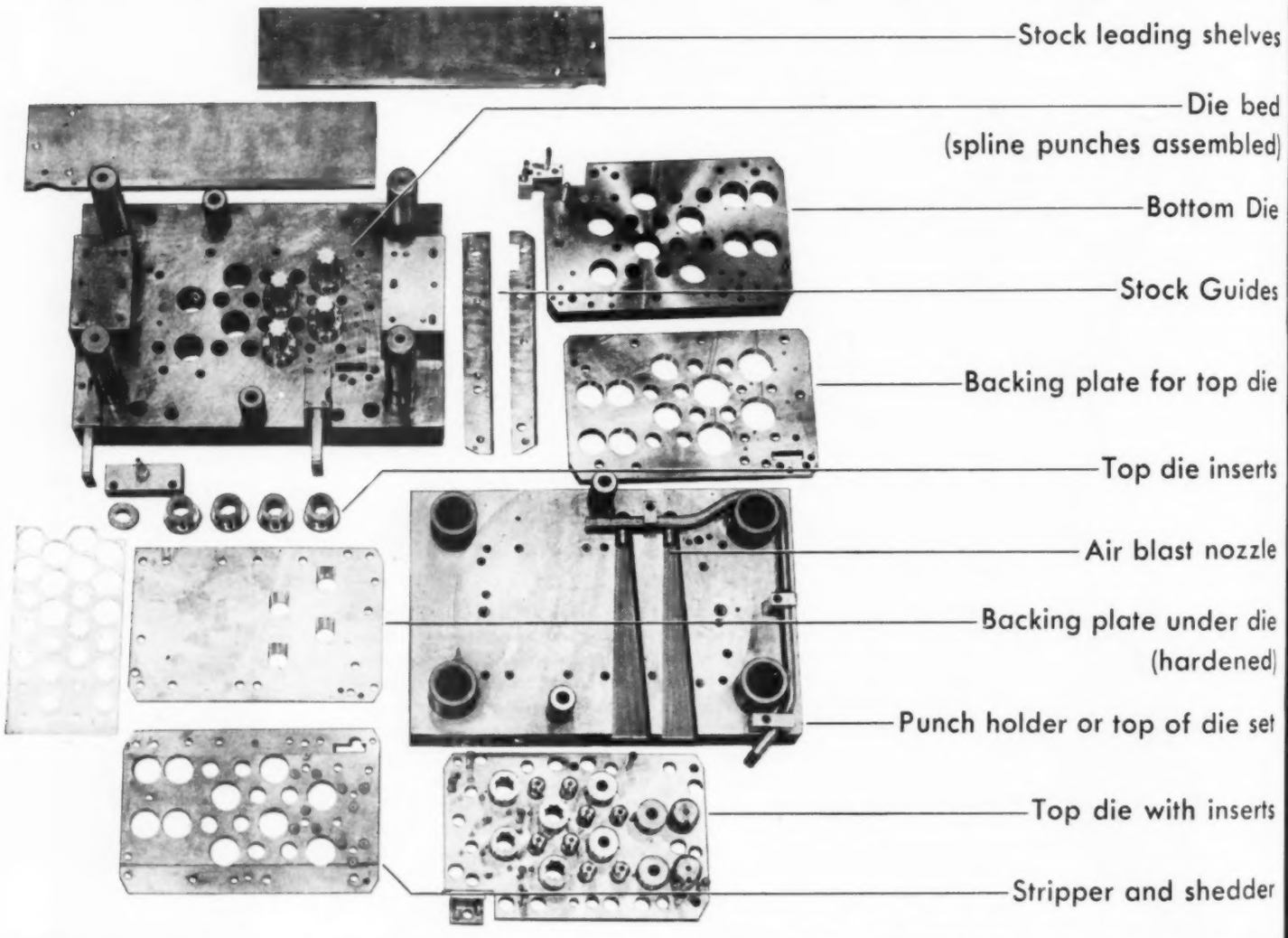
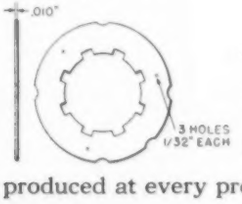
Could you produce 10 of these dies in 5 months by your present methods?



QUADRUPLE DIES PRODUCED INTERCHANGEABLY IN THE MOORE SPECIAL TOOL COMPANY'S TOOLROOM



TAKE A GOOD LOOK at this disassembled quadruple die. Combining compound and progressive features, it produced at every press stroke four fragile splined washers to close dimensions.

Now take another look. *Ten of these dies were made in five months.*

Impossible, you say? Yes, without advanced and accurate hole location methods. To start with, the piece parts would have to be stamped out in one-at-a-time dies instead of quadruple. And since the die parts could only be made progressively, a single die would be a one-man assignment. Add to this, transferring hardening distortion errors through the die into the other plates. At least a

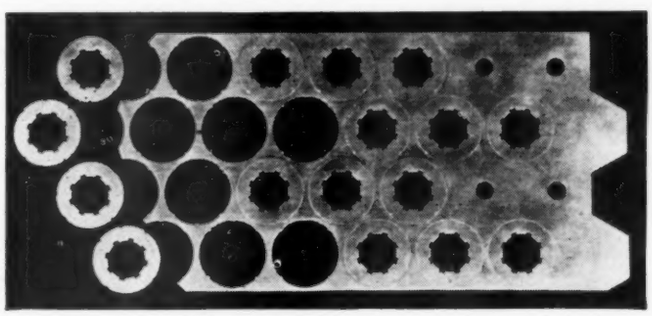
year of uninterrupted production would be required to complete one die.

But this mass-die-production is a triumph of the principle of interchangeable parts-and-assembly applied to toolmaking...made possible by the Moore Jig Borer and the Moore Jig Grinder working as toolroom partners. Accurate hole locations could be attained with speed and ease *only* by jig-boring the holes, applying the Moore lead screw principle of coordinate hole location and, after hardening, finish-grinding them on the only machine of its kind—the Moore Jig Grinder.

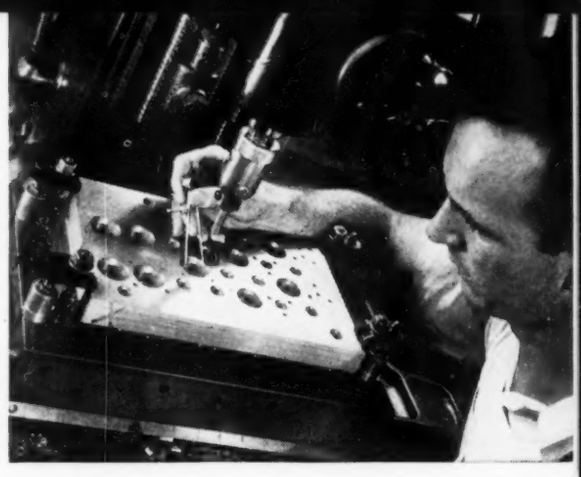
The first die was produced in three months! All parts were made concurrently to pre-engineered dimensions right down to the dowel holes in the compound-station inserts. And even the detents in the final blanking punches were jig-ground; the detents in the blanking dies were inserted round pieces, set into jig-ground holes.

Complex dies produced and assembled like automobile parts! And you can do the same. *You, too, can work to figures instead of "to fit."* Start on it today by writing for complete literature on the Moore Jig Borer and Moore Jig Grinder.

MOORE SPECIAL TOOL COMPANY, INC.
738 UNION AVENUE, BRIDGEPORT 7, CONN.

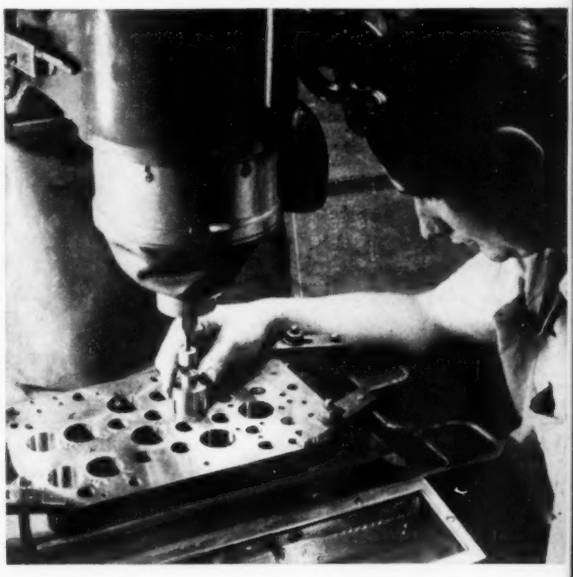


Scrap and four splined washers produced at every press stroke



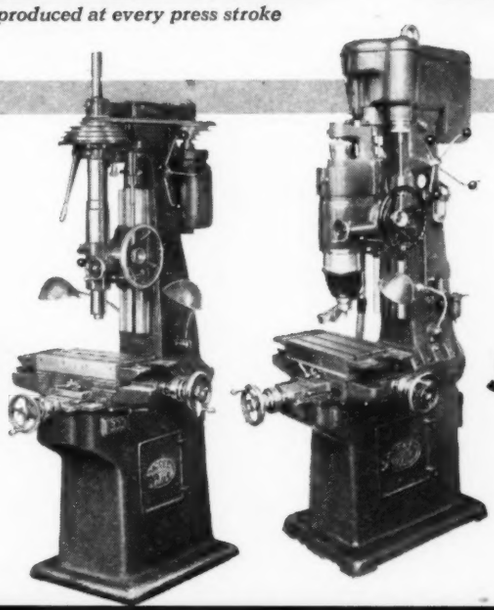
Here's Interchangeability in Toolmaking

How duplicate die blocks of 10 quadruple dies were produced concurrently for interchangeable assembly. Holes in die block are bored in Moore Jig Borer while equivalent holes in a duplicate die block are ground, after hardening, in Moore Jig Grinder.



MOORE MASTERPIECES OF TOOLS

MOORE JIG BORER



MOORE JIG GRINDER

YEARS OF "KNOW-HOW" GIVE YOU

Proven Design and Extra Life

IN

TAFT-PEIRCE

TUNGSTEN CARBIDE

GAGES

As the pioneer producer of Tungsten Carbide Gages, Taft-Peirce years ago recognized the economies *for you* which are inherent in the application of these super-hard, long-wearing materials to gage construction. And Taft-Peirce has built carbide gages ever since—thousands of them—of every conceivable variety. Why not use this background of experience as your source of supply? It will increase the quality of your own product, give you standards on which you can depend. Write for the new Taft-Peirce Handbook, just off the press. In it you can find a gage for every purpose.

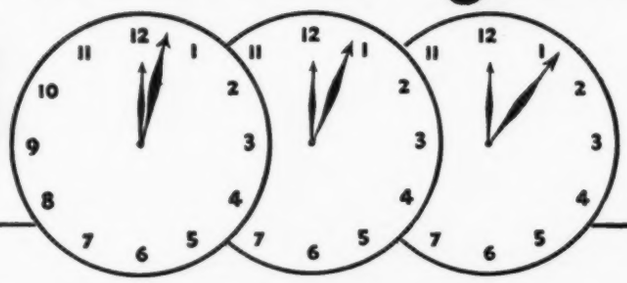
TAFT-PEIRCE GAGES

Standards on which you can depend

The TAFT-PEIRCE MANUFACTURING CO.

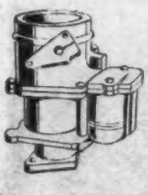
WOONSOCKET, RHODE ISLAND

How to Cut Metal Cleaning Time to MINUTES



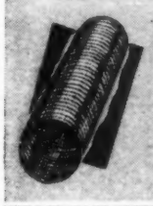
NEW, FAST-ACTION DETERGENT CLEANS FERROUS AND NON-FERROUS METALS...Easy to Handle

TYPICAL USES FOR Solvent "26"



CARBURETORS—Solvent "26" removes gum, gasolene sediment and other accumulations of dirt.

SPARK PLUGS—Solvent "26" safely cleans porcelain; helps loosen carbon deposits.



METAL PLATES AND SCREENS—Solvent "26" restores clear, clean finish to any metal surface.

DIES AND STAMPING—Solvent "26" removes drawing compounds from die-formed or stamped metal.

LABORATORY EQUIPMENT—Solvent "26" frees glass and metal tubing and their supports of gums, varnishes and other incrustations or deposits.

PISTONS—Removes lacquers, gums, resins, etc. from gas, gasolene and diesel engine pistons and rings. Also effective for cleaning all parts of dismantled motors, engines and machinery.

REMOVES:

Oil • Grease • Gums • Varnishes • Lacquers • Paints
Carbonaceous Deposits • Asphaltic Products

FROM:

Steel • Cast Iron • Aluminum • Porcelain • China
Chrome and Nickel Plate • Stone • Precious Metals
Brass • Washable Fabrics

Used throughout the war in critical industry as a superior cleaning agent, newly-developed SOLVENT "26" is now available for all industrial needs.

Offering many advantages in time, labor and cost over other present cleaning methods . . . Solvent "26" is so effective a detergent it can be used at *ordinary* room temperatures.

The fast action of Solvent "26" reduces cleaning time from hours to minutes on dismantled engine parts and all kinds of machinery. Simply dip, rub, brush or spray it on. Then flush clean with hot water.

Mail the coupon today for literature and information leading to a demonstration of this unique product in your own plant.

CITIES SERVICE OIL COMPANY
ARKANSAS FUEL OIL COMPANY

CITIES SERVICE OILS
ONCE-ALWAYS

Cities Service Oil Company
Room 603
70 Pine Street
New York 5, N. Y.

Gentlemen: I am interested in a demonstration of Solvent "26"—at no cost or obligation.

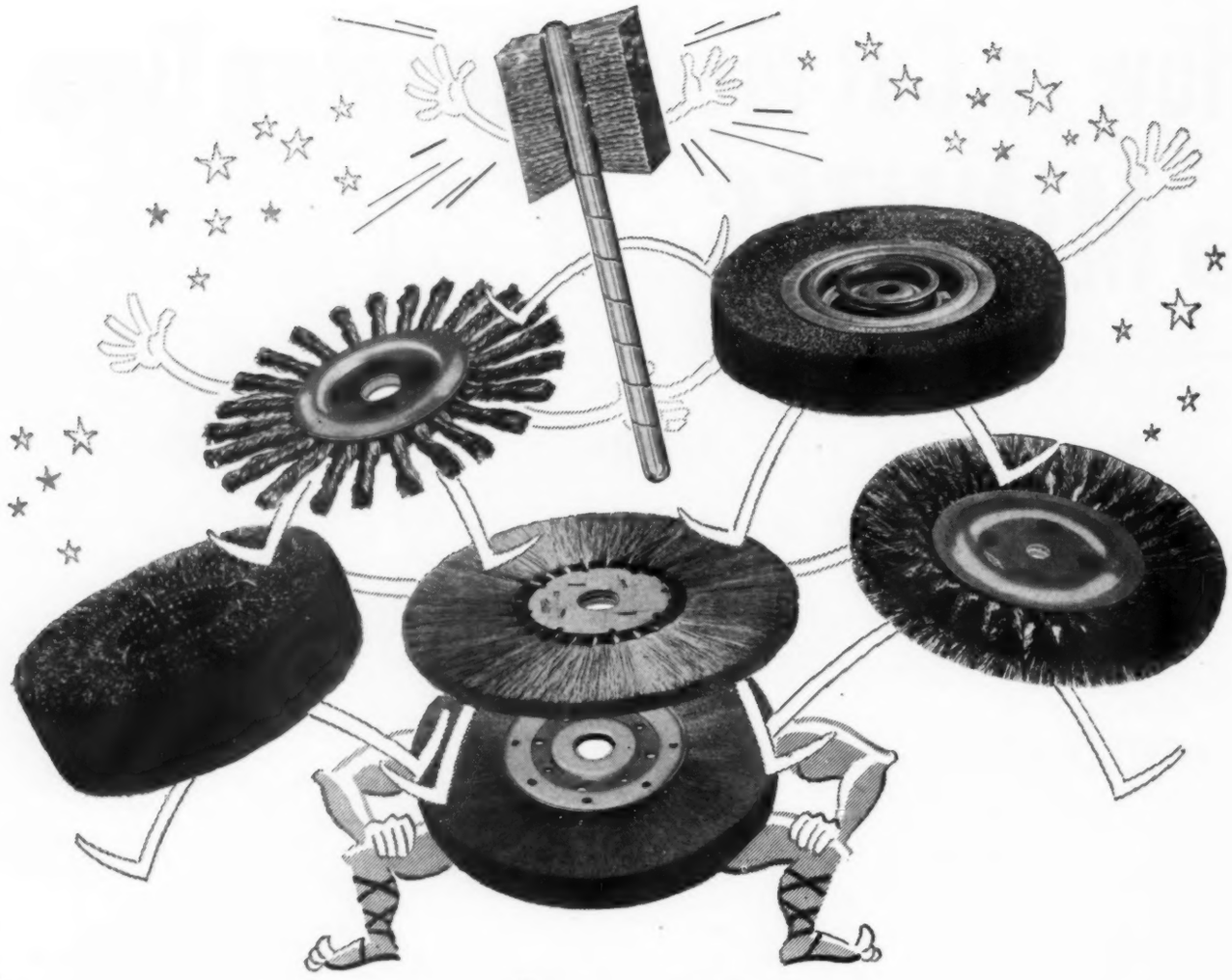
Name.....

Title.....

Company.....

Address.....

City.....State.....



A New Performer

has been added to the world's leading family of best-performing brushes

THE outstanding performances of Osborn brushes—whether they be Master Wheels or Monitors or Disc Center Sections—have won the plaudits of the industrial world.

Now a new performer has been added to the Osborn lists—a power brush like none you ever saw before! It's called the SITUFT. It was developed by Osborn engineers in the last months of the war—and it literally performed miracles of production.

The Situft is built on an entirely new principle of wire suspension. It can do jobs no other brush (in some cases, no other tool) could ever do before. Its cost is almost unbelievably low—17¢ per brush—yet it has saved thousands of dollars in production costs—**cleaning, deburring and surface finishing internal, hard-to-get-at places.** A complete tool crib kit containing one each of all 12 sizes (¼" to 1¼") and 2 holders costs $2.85. You ought to have one. Kits and open stock available from your local Osborn distributor.

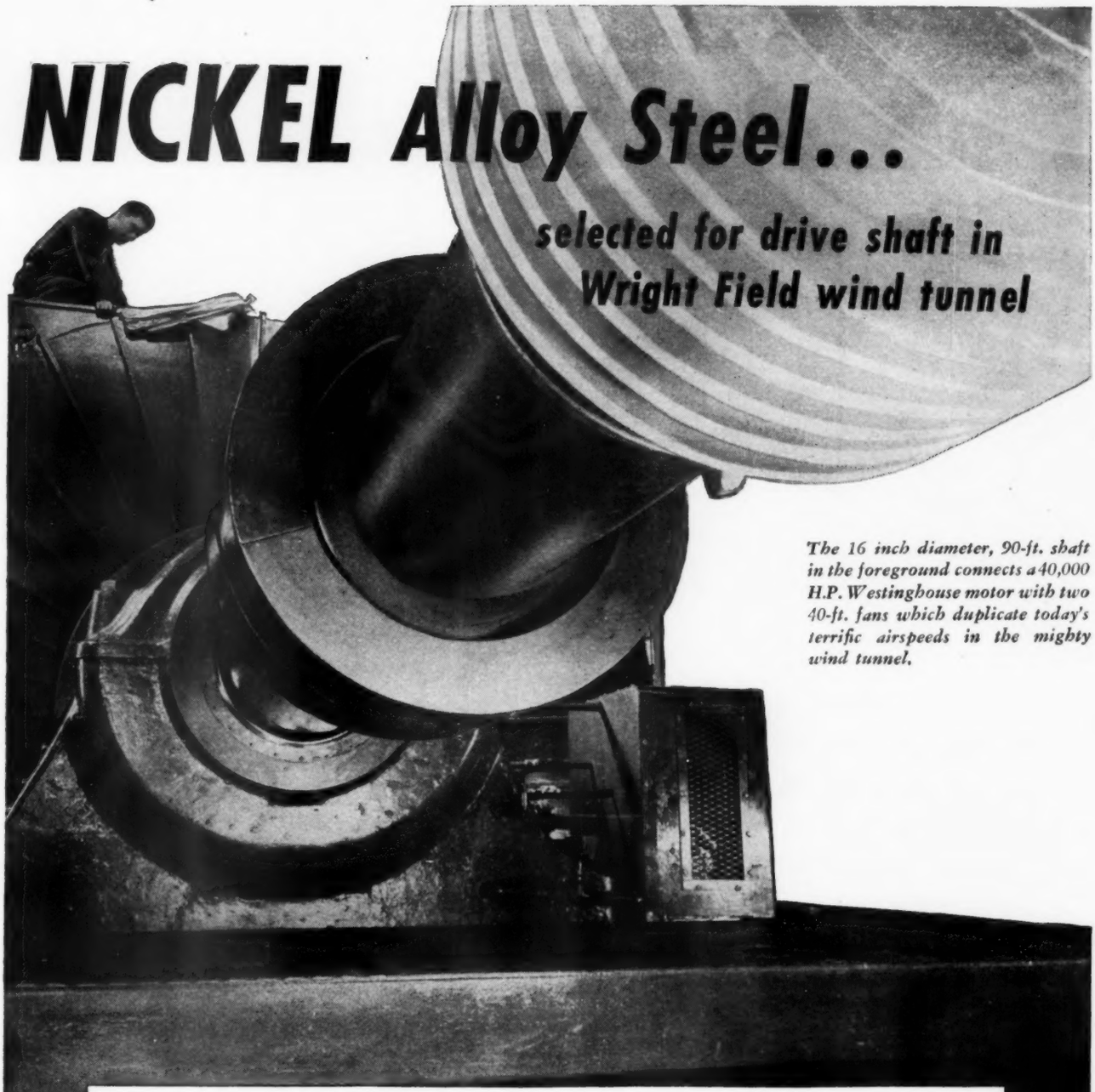
Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

THE OSBORN MANUFACTURING COMPANY
5401 Hamilton Avenue *Cleveland, Ohio*

NICKEL Alloy Steel...

selected for drive shaft in Wright Field wind tunnel



The 16 inch diameter, 90-ft. shaft in the foreground connects a 40,000 H.P. Westinghouse motor with two 40-ft. fans which duplicate today's terrific airspeeds in the mighty wind tunnel.

The high mechanical properties required for this large drive shaft were specified by Westinghouse Electric Co., Inc., suppliers of the wind tunnel motor and auxiliary equipment.

To meet the specifications, a Nickel-molybdenum steel was selected.

Significant are test results on bars from prolongations of the forgings, after normalizing and tempering:—

Ultimate tensile strength	117,500 p.s.i.
Yield Point	90,500 p.s.i.
Elongation in 2"	20.0 %
Reduction in Area	55.4 %

We invite inquiries on the uses and selection of Nickel alloy steels, and other Nickel alloys.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Specify "3C" FOR SAFE, TROUBLE-FREE ACROSS-THE-LINE STARTING OF SQUIRREL CAGE MOTORS

BULLETIN 6013
ACROSS-THE-LINE STARTER

BULLETIN 6013 MAGNETIC STARTER
IN NEMA TYPE 7 ENCLOSURE
FOR HAZARDOUS LOCATIONS

BULLETIN 6018
SAFETY SWITCH

BULLETIN 6020 STARTER
WITH CIRCUIT BREAKER

BULLETIN 6002
MANUAL STARTER

BULLETIN 6030
REVERSING STARTER

BULLETIN 6050
MULTI-SPEED STARTER

Here's why "3C" MOTOR CONTROLS *give you* MAXIMUM SAFE SERVICE *with* MINIMUM MAINTENANCE

Clark Controls for Squirrel Cage Motors are expertly designed and built of materials specifically selected to withstand hard day-in and day-out service. They include the following features:

- Large electrical clearance.
- Non-carbonizing arc shields.
- Plenty of wiring space despite compact size.
- Thermal overload relays with external reset.
- Silver-to-silver double break N. O. or N. C. control circuit contacts.
- Vertical-lift hinged armature-type magnets, with low-operating current characteristics, will not close from accidental jarring.
- Sturdy drawn steel cabinets with knockouts and provision for locking.
- Wide range of types to meet particular requirements.

Our Distributors and District Offices will welcome your inquiries

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES

RETOOLING definitely demands The right file for the job

A NICHOLSON FLAT SECOND CUT FILE (shown at right) is being used above in filing a punch die

DIES, jigs, fixtures, gauges, cams, trips, holders, spindles—the closer the tolerances to be worked out by hand, the more careful should be the selection of files . . . Second Cut files instead of Coarse or Bastard; Smooth instead of Second Cut; Swiss Pattern or Special Purpose instead of Regular; etc.

Nicholson is virtually a "file engineering laboratory"—an establishment where the requirements of files for different purposes and metals are a never-ending study. Right now, setting up production lines and machines under reconversion programs is making pressing demands on tool and die shops; and the Nicholson factories are taking into full account the files such activity calls for.

Consult your mill-supply house on the files you need both for retooling and for product manufacture. On particularly knotty filing problems, write us direct—and freely.

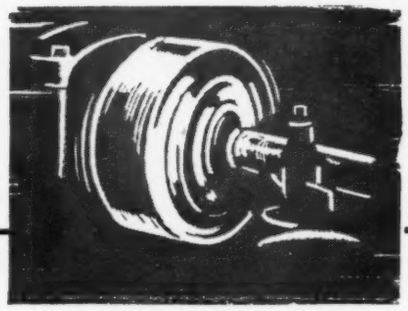
NICHOLSON U.S.A.

NICHOLSON FILE CO. • 29 ACORN ST., PROVIDENCE 1, R. I.
(In Canada, Port Hope, Ont.)

BLACK DIAMOND TRADE MARK

NICHOLSON FILES *FOR EVERY PURPOSE*

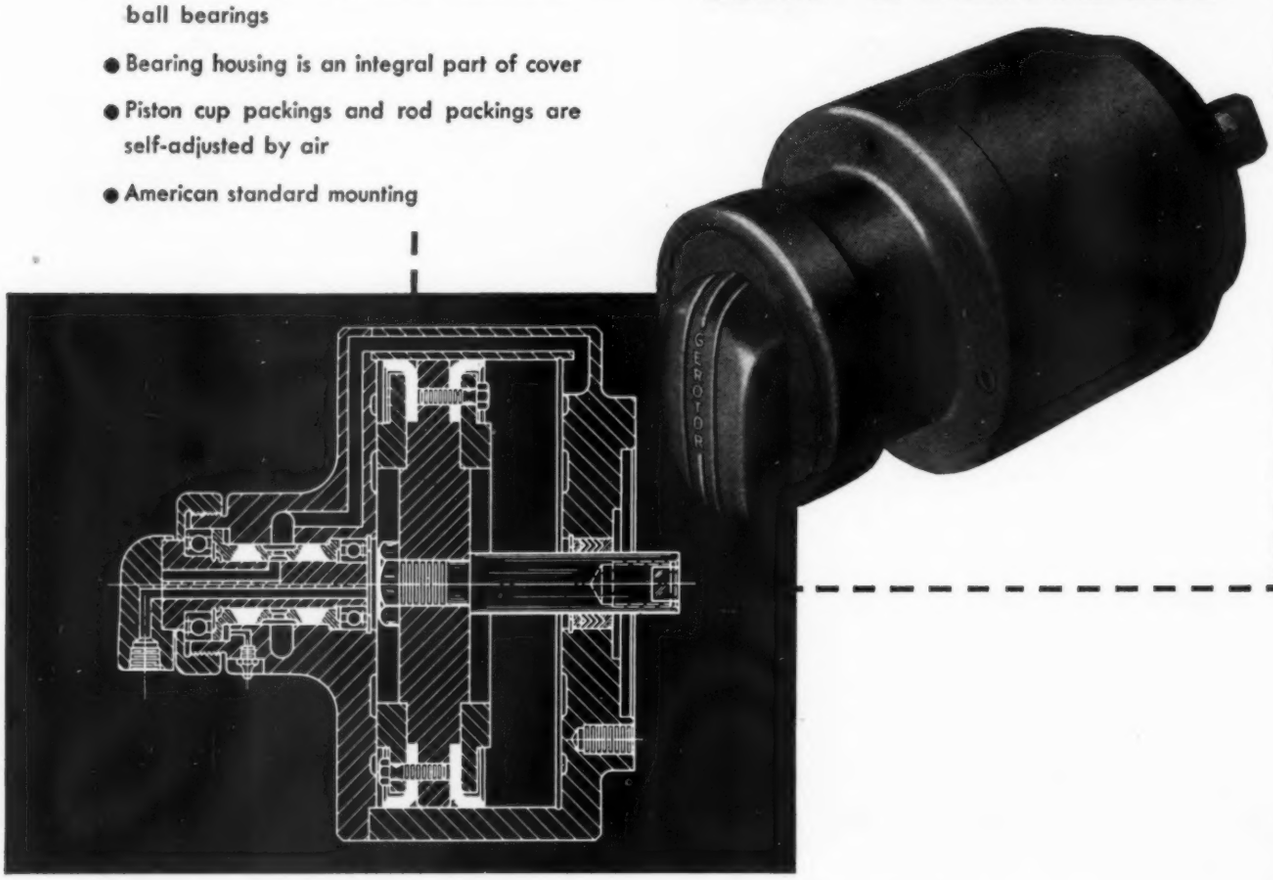
WANT POSITIVE CHUCKING CONTROL AT HIGH SPEEDS?



Check the GEROTOR ROTATING AIR CYLINDER

● The Model 10 Gerotor Rotating Air Cylinder has been designed for use on high speed spindles to operate air chucks, mandrels and other work holding devices with permanent alignment.

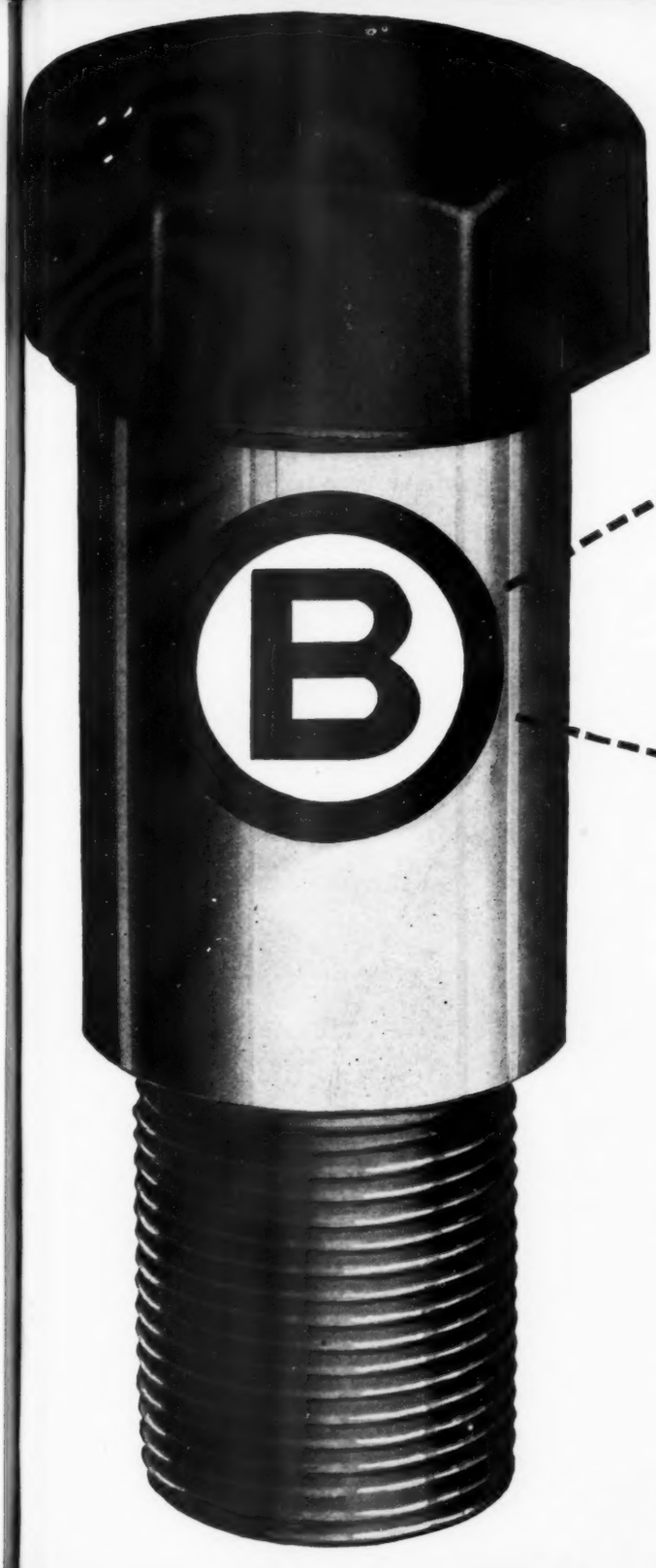
- Castings are all light-weight aluminum
- Stationary stem is precision mounted on ball bearings
- Bearing housing is an integral part of cover
- Piston cup packings and rod packings are self-adjusted by air
- American standard mounting

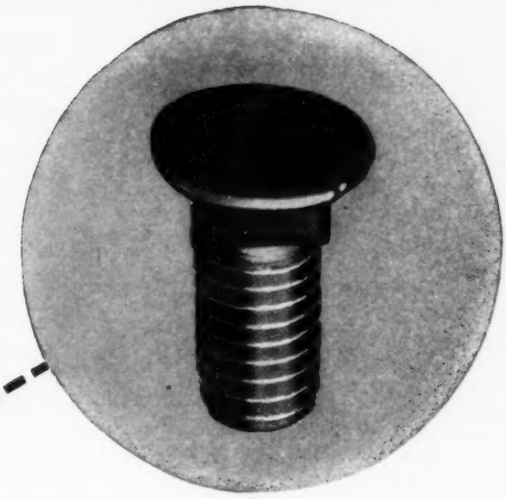


GEROTOR MAY CORP.

LOGANSPORT, INDIANA

PLANTS AT BALTIMORE, MARYLAND, • LOGANSPORT, INDIANA





CIRCLE Ⓑ from billet to bolt...and that means uniform, controlled quality

From billet to finished product the manufacture of all circle Ⓑ fasteners is controlled in one plant—the largest independent in the country. For this reason you can depend on the hundred thousandth bolt or nut leaving the machine to be as accurate in size shape and thread as the first.

THE UNIFORM QUALITY OF ALL CIRCLE Ⓑ PRODUCTS BEGINS IN OUR OWN ROLLING MILLS.

Ⓑ BUFFALO BOLT COMPANY

NORTH TONAWANDA, NEW YORK

There is No Substitute For a Spring Washer

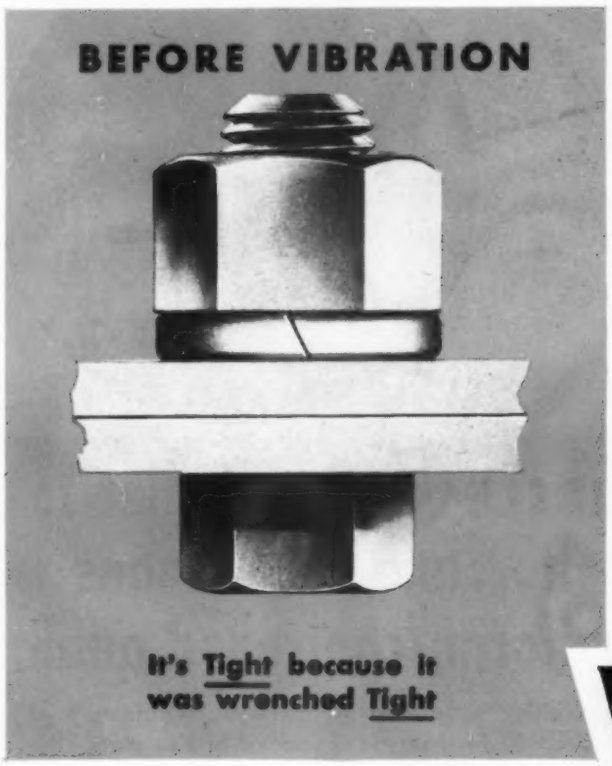
Every practical man knows that wear occurs when vibrating metal contacts metal; even when seemingly bolted tight.

He knows that bolted assemblies loosen because of bolt stretch, and the frictional wear of burrs, flares, and the pulverizing of paint, scale and rust.

He knows that even if the nut never budges, the other parts of assemblies wear loose unless a strong spring washer is used to expand as wear occurs—to expand continually, over long range if necessary, to hold all parts tight longer.

There is no substitute.

On all assemblies specify Kantlink spring washers for real bolted security.



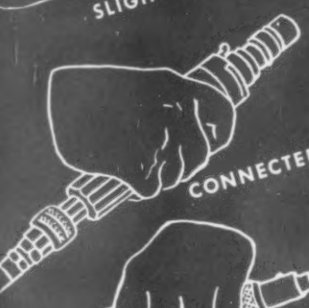
Originators of KANTLINK the long-range spring washer

THE NATIONAL LOCK WASHER COMPANY

Newark 5, New Jersey **Milwaukee 2, Wisconsin**

ECONOMY THRU EFFICIENCY!!

SLIGHT PUSH — IT'S CONNECTED



CONNECTED

EASY PUSH ON SLEEVE — IT'S DISCONNECTED

HANSEN COUPLINGS SAVE

TIME • MATERIAL • MONEY

You see more Hansen couplings in daily operation in plants all over the country, because when the pressure was on for peak production during the war Hansen couplings outperformed all others and were a contributing factor in not only peak production but economical and efficient production.

Today, economical and efficient production head the list of "musts" in any industry. Make no mistake about this...no coupling on the market has the all 'round advantages of Hansen couplings.

Hansen Push-Tite couplings are simple and easy to operate, slight push of plug into socket it is connected and air is automatically turned on, easy pull on sleeve with thumb it is disconnected and air is automatically shut off. No twisting or turning to lock, connect or disconnect, no kinking of hose due to swivel action.

Hansen Push-Tite couplings will handle pressures from ounces to well over 10,000 pounds without leaking.

There's a Hansen coupling for air, oil, grease, oxygen, gasoline and acetylene and they come in a wide range of sizes.

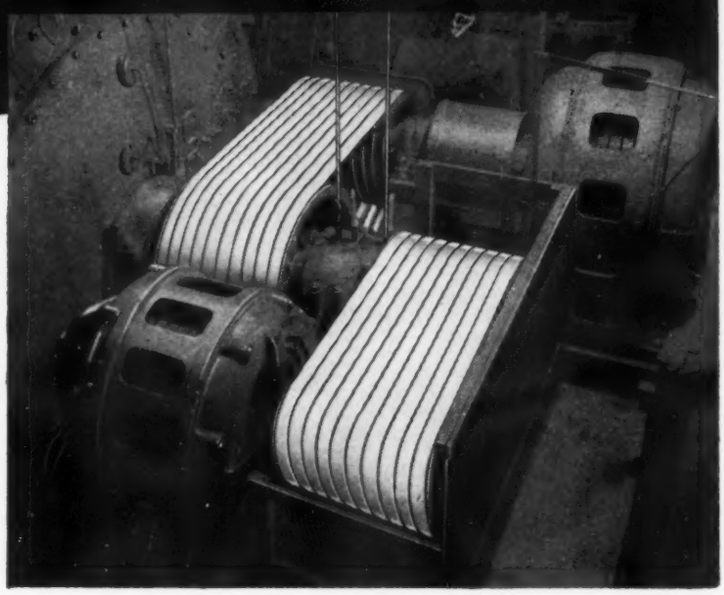
Every day new uses are found for Hansen couplings, perhaps you have a problem that can be licked by the adaptation of one of our couplings, their versatility and uses are unlimited. • *Send in for free industrial catalog.*

THE HANSEN MFG. CO.

1786 EAST 27th STREET • CLEVELAND 14, OHIO

It's the REASON for this Fact that's important

Your *Standard* GATES VULCO ROPES Are Today OUT-PERFORMING Any V-Belts Ever Built Before



Early in the war it was found that **no** V-belts then being built by **anyone** could stand the combat-service requirements of the Army's tanks, tractors, and self-propelled big guns. For this unprecedented severity of service, Gates developed and built V-belts far stronger and more durable than any V-belts ever built before—and here is why this fact is NOW important to YOU:—

HERE is the reason

Every improvement developed by Gates for these Army V-belts has also been added, day by day, to the quality of the standard Gates Vulco Ropes which have been delivered to you.

Here is one of the very few instances in which improvements developed primarily for military use were passed on immediately to you. Ordinarily, that could not be done. Gates V-belts were made an exception because it was recognized that industry needed the best possible V-belts in order to achieve the greatest possible production—and maximum production was one of the nation's vital needs.

That is why Gates has been able to pass on to you, day by day, every V-belt improvement developed for our armed forces during the war—and that is why your Standard Gates Vulco Ropes are today outperforming any V-belts ever built before!

All Gates V-Belts are Built With *The Patented* **CONCAVE SIDE**

Gates

THE MARK OF SPECIALIZED RESEARCH

THE GATES RUBBER COMPANY

Engineering Offices and Jobber Stocks in All Large Industrial Centers

462

GATES VULCO ROPE DRIVES

CHICAGO 6, ILL., 549 West Washington. NEW YORK CITY 3, 215-219 Fourth Avenue. ATLANTA 3, GA., 521 C. & S. Nat'l Bank Bldg.

LOS ANGELES 21, CAL., 2240 E. Washington Blvd. DENVER 17, COLO., 999 S. Broadway. DETROIT 2, MICH. 223 Boulevard Bldg.

PORTLAND 9, ORE., 333 N.W. 5th Ave. DALLAS 2, TEXAS, 1710 N. Market St. SAN FRANCISCO 3, CAL., 170 Ninth St.

Rigidity, precision and endurance under heavy loads are attributes of Bunting Cast Bronze Bearings. The oil film insulates against noise and wear. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.
Bunting
BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS
34

ROTO-FINISH parts mechanically— and you de-burr automatically!

TWO operations in one are performed by Roto-Finish. This mechanical method of chips and compounds not only finishes and colors surfaces suitable for plating, but likewise, by its controlled action, removes burrs from edges, smoothes sharp corners to close tolerances. It de-burrs parts weighing up to 75 lbs. per piece.

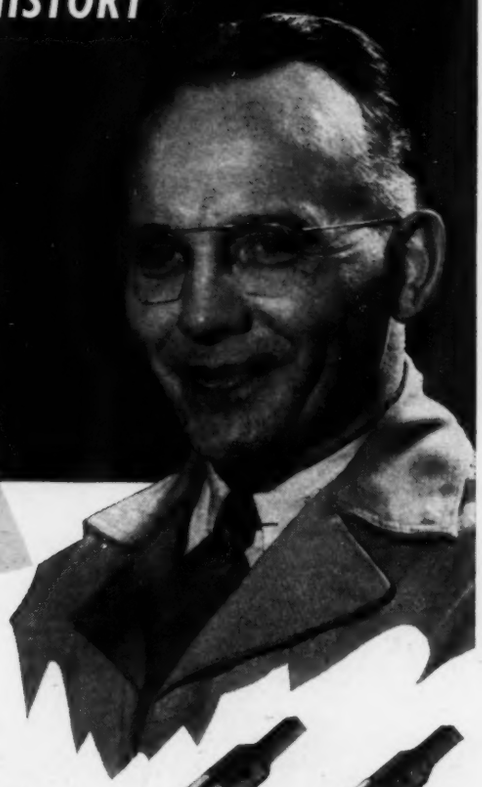
Roto-Finish steps up production by combining these two jobs and eliminating hand labor. It likewise cuts costs by saving man hours. Roto-Finish processes parts of steel, brass, aluminum, magnesium, stainless and nickel steels. It finishes parts for plating weighing a few ounces to approximately one lb. per piece.

Investigate Roto-Finish and add this precision and economical process to your production. Take advantage of our offer to process your parts and furnish complete information. No obligation. THE STURGIS PRODUCTS CO., 603 Jacobs Street, Sturgis, Michigan.

ROTO FINISH

THE UNIFORM MECHANICAL PROCESS—
FOR GRINDING • DE-BURRING • POLISHING • HONING • COLORING

ALBERT SCHRUM REPORTS A "CASE HISTORY"



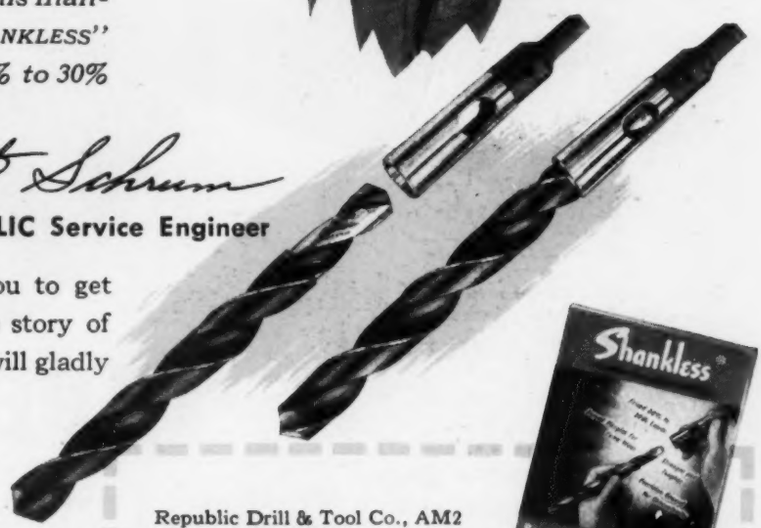
7 TIMES AS MANY HOLES PER GRIND with "Shankless"*

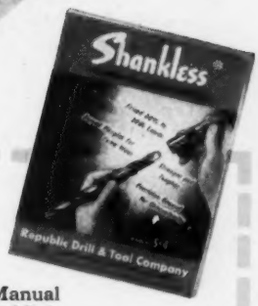
They were getting 25 holes per grind with conventional taper shank drills. When they changed to "SHANKLESS" they drilled an average of 174 pieces per grind on the same job—7 times as many. No wonder this manufacturer now standardizes on "SHANKLESS"—especially since they cost him 20% to 30% less than conventional drills.

Albert Schrum

REPUBLIC Service Engineer

If you use twist drills, it will pay you to get our Manual S-4. It tells the complete story of "SHANKLESS" Roll-Forged Drills. We will gladly send a copy to you on request.





Republic

ALSO MAKES OVER 100 DIFFERENT TYPES OF CONVENTIONAL HIGH SPEED AND CARBON STEEL DRILLS

**Registered at U.S. Patent Office*

Republic Drill & Tool Co., AM2
322 South Green Street
Chicago 7, Illinois

Please send me a copy of your new Manual which gives the complete story of Republic's "Shankless" Drills.

Name .....

Address .....

City ..... *Zone* .... *State* .....

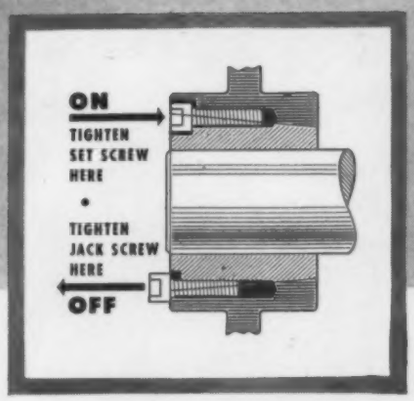
Republic DRILL & TOOL COMPANY

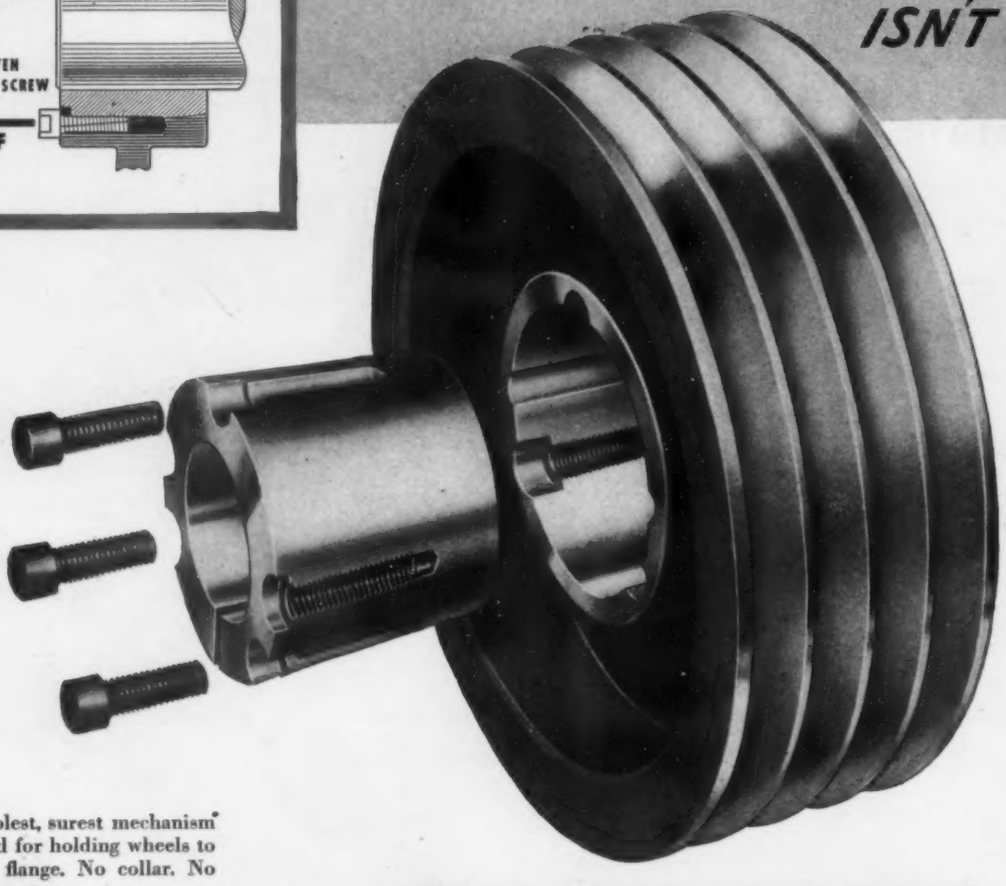
CHICAGO 7, ILLINOIS

BOSTON • NEW YORK • PHILADELPHIA • PITTSBURGH • CLEVELAND • DETROIT • DAYTON • BIRMINGHAM • LOS ANGELES • SAN FRANCISCO

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF TWIST DRILLS

Simple, ISN'T IT?





- The simplest, surest mechanism ever devised for holding wheels to shafts! No flange. No collar. No protruding parts.
- The Taperlock Sheave mounts as a complete unit. Slip it on, line it up and tighten *while sighting*. It's in place on the first try!
- The bushing is wedged into the sheave by means of set screws—with a firmness equivalent to a shrunk-on fit—whether the shaft is standard or normally undersize.
- The Taperlock runs *true*. The bushing extends the entire length of the hub; it provides a *full* bearing surface.
- Close mountings are made possible. No flange nor collar nor other device is required at either end of the sheave hub.
- The Taperlock "unlocks" with less effort than any other sheave—due to its special taper.
- Taperlock Sheaves will be stocked by Dodge Transmissioneers in principal cities—and will be available in ALL stock sizes.

New TAPER-LOCK *Sheave*

PATENT APPLIED FOR

Easy on—easy off—locks fast to the shaft! ALL the advantages you've ever dreamed about in a sheave are *here*—in the simplest, quickest acting mechanism ever developed for the purpose!

For full details call your local Dodge Transmissioneer. You'll find his name listed under "Power Transmission Equipment" in your classified telephone directory. Or write

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

DODGE
MISHAWAKA

SIGN OF THE DODGE TRANSMISSIONEER
There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you NEW and BETTER ways of transmitting power. See your local classified telephone directory.

MACHINE TOOL CONTROL

built to Specification

New electrical standards for machine tools have been announced after joint conference of the National Machine Tool Builders' Association and representatives of large users (primarily among the automotive industry). Characteristic construction features required are shown below. Requirements peculiar to the automotive industry are shown in *italics*.

ENCLOSURE: NMTBA:
Semi-dust tight (NEMA Type IA) enclosure has no unfilled holes when mounted.

Hinged cover swings horizontally and has adequate means for fastening in closed position.

AUTOMOTIVE:

Enclosure with no holes necessitates external mounting feet.

Cover must be held closed with bolts or screws which require the use of a tool to remove.

REDUCED VOLTAGE CONTROL CIRCUITS: NMTBA:
110 volt control circuit is obtained from a transformer with isolated secondary winding protected by fuses or equivalent overcurrent protective devices.

All operating coils of magnetic devices are connected to the same side of the control circuit with no contacts interposed except overload relay contacts. A terminal is provided on panel for grounding coil side of transformer secondary if conditions permit.

AUTOMOTIVE:

Additional transformer capacity is provided for a 100 watt, 110 volt machine light.

Transformer will have dual primary winding for 220/440 volts unless otherwise specified.

DISCONNECT SWITCH: NMTBA:
NEMA Type A Manually operated, non-fusible switch or circuit breaker disconnects are arranged to be locked in "OFF" position and are mechanically interlocked with control enclosure door. Fusible disconnect switches are available when specified.

PANEL WIRING: NMTBA:
Wires are supported mechanically where necessary to keep them in place.

Terminals are provided for all outgoing wires.

Terminal markings correspond with the markings on the wiring diagram. Wire insulation is synthetic compound, not less than 3/64" thick. Load and control circuits are distinguished by color.

BASE PLATE: NMTBA:
All front connected devices are mounted on rigid base plate to permit removal of complete control panel.

Ample room is provided between base plate and enclosure for proper maintenance and electrical clearance.

WIRING DIAGRAMS: NMTBA:
Attached to inside of control enclosure door by adhesive material or permanent data pocket, depending on size.

Elementary diagram is included on wiring diagram.

CONTROL DEVICES: NMTBA:
Devices such as motor starters, contactors, timers, etc. are built to ASA and NEMA standards and are designed to facilitate combination into special control panels.

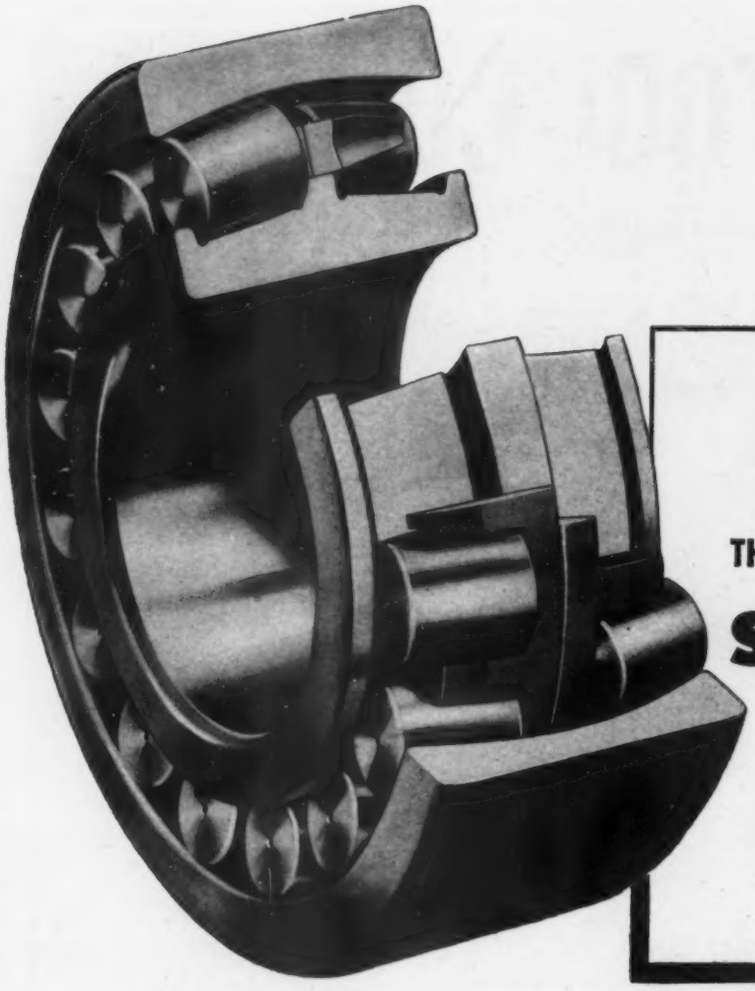
AUTOMOTIVE:

No starter smaller than Size 1 used on any motor.

SQUARE D is prepared to build control to NMTBA and Automotive Standards or any other specification developed to promote safety of personnel, uninterrupted production and long life. Square D Field Engineers, stationed in branch offices in all principal cities, are thoroughly qualified to assist in the design and application of such control.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



Announcing

THE TORRINGTON SELF-ALIGNING

SPHERICAL ROLLER BEARING

In addition to the many advantages provided by Torrington's proficient engineering and precision manufacturing, the new Torrington Spherical Roller Bearing offers these features:

- Self-Alignment
- Two-Directional Thrust
- High Radial Capacity
- High Thrust Capacity
- Unit Construction for Easy Installation

To meet the increasingly exacting demands of industry, Torrington has added to its regular line a bearing specifically adaptable to heavy-duty performance... the Self-Aligning Spherical Roller Bearing.

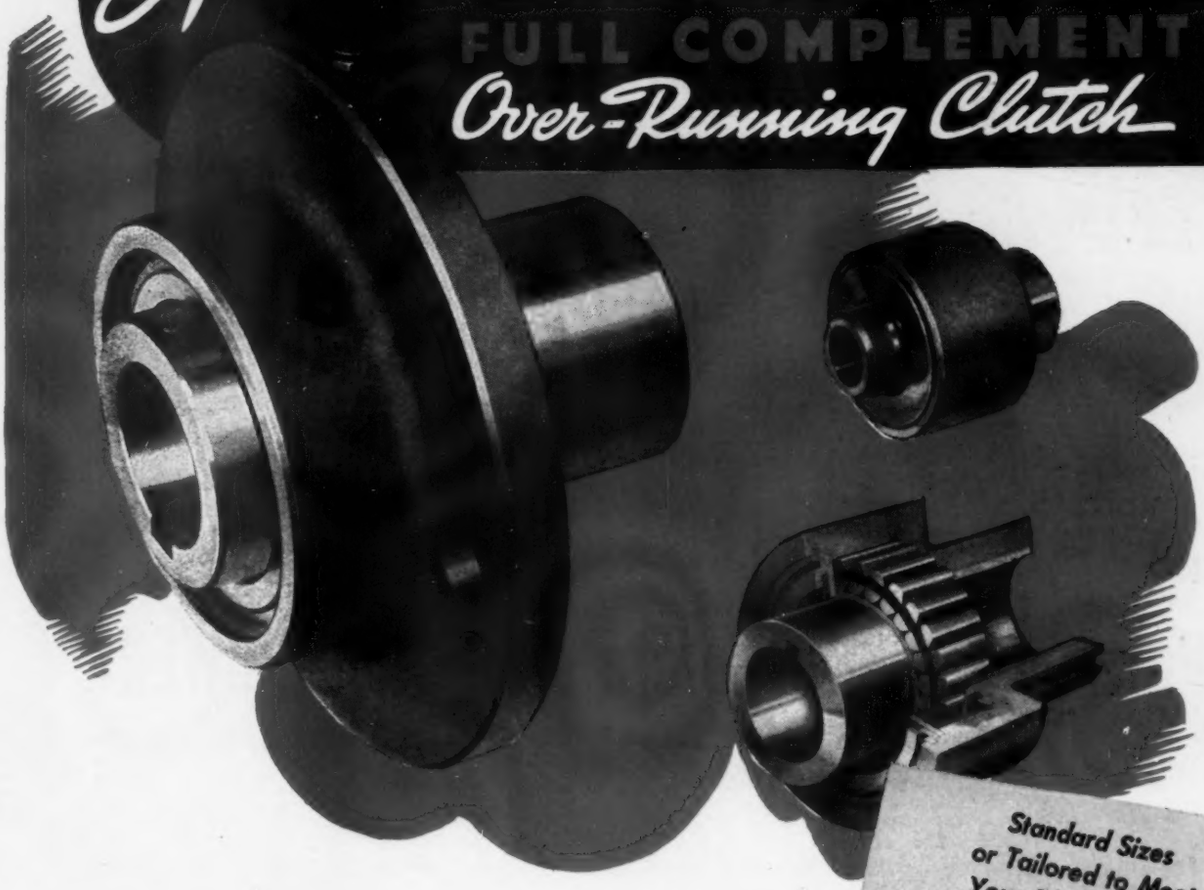
This new bearing will be available in a full range of sizes from 1.5748" bore and up. It is backed up by the same specialized engineering knowledge which for years has made Torrington's Bantam Bearings Division a leader in the design and construction of custom-built bearings. For further information write for our Bulletin No. 100A.

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA

TORRINGTON BEARINGS

SPHERICAL ROLLER • STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

Specify— FORMSPRAG FULL COMPLEMENT Over-Running Clutch



Formsprag over-runs freely on the slightest reduction in the speed of the driving member. It is compact, simple, rugged—with extremely high torque capacity. It is instantaneous in action, without backlash or lost motion.

On dual drives, or with a stand-in power unit, Formsprag permits the use of either power unit singly, or both together. On multiple speed drives the low speed is automatically cut off when the high speed cuts on.

Formsprag may be used as a safety factor to prevent damage by reverse motion of a shaft. It is the ideal control for drive feed rolls because it offers an infinite number of stops.

Standard Sizes or Tailored to Meet Your Requirements

Formsprag is available in a wide range of capacities, both plain and ball bearing types.

Formsprag is delivering outstanding performance on spring coilers, printing presses, rubber and paper calenders, punch press feeds, dual power drives, logging, hoisting, textile weaving and wrapping machinery.

Standard sizes meet many conditions, but if your product requires special clutches our engineering division is equipped to design the proper clutch to meet your requirements.

Please give full information when writing—a description of the operation, normal and maximum torque at specified speeds, the number of times per minute the clutch engages and disengages, and other information pertinent to the installation.

ARMY E NAVY

Illustrated literature, including capacity ratings of all standard sizes, available on request.

The GEAR GRINDING MACHINE COMPANY
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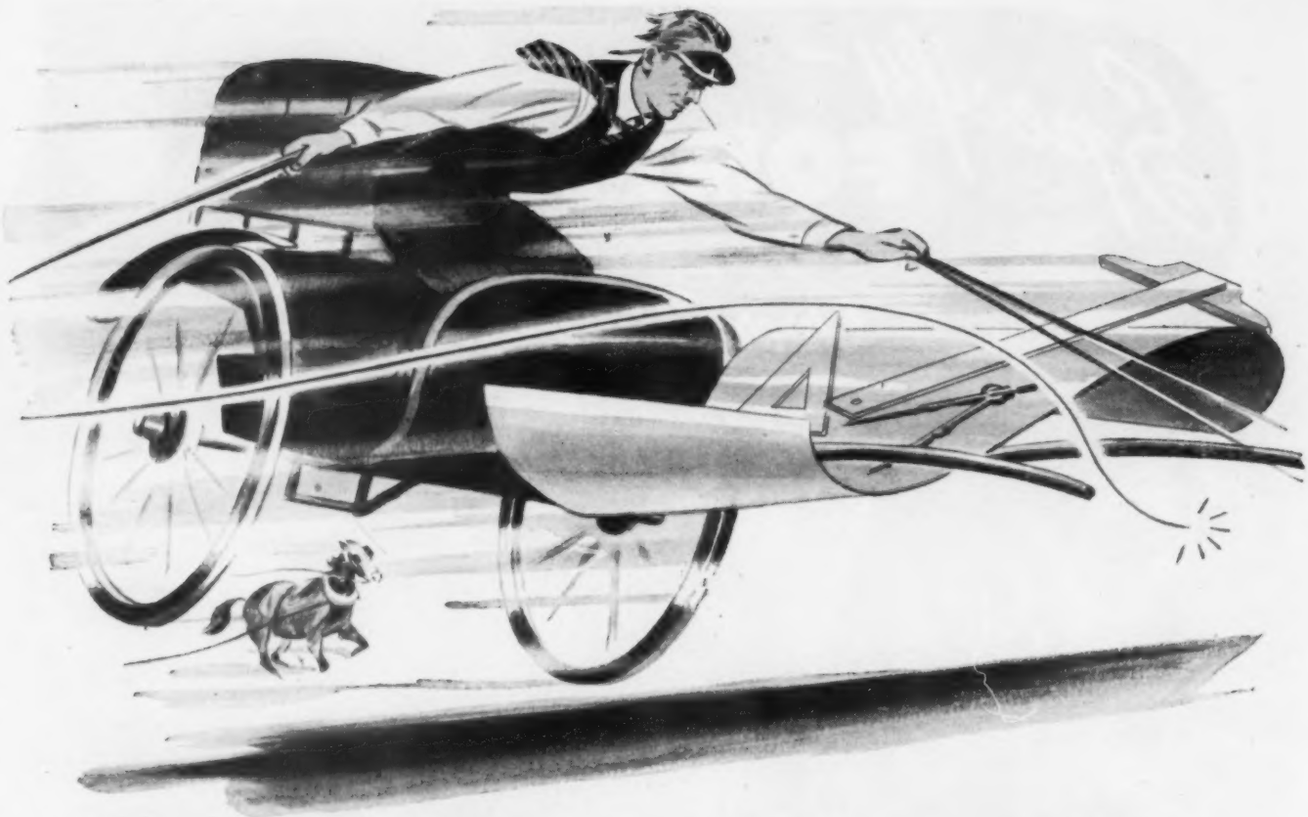

Putting the CART before the HORSE-POWER

— is smart planning

The machine designer who starts with a standard motor in mind and builds a machine around it, often winds up with equipment that is only a compromise with his original idea.

The Welco-wise design engineer doesn't limit himself. He just plans the machine to do the best job the best way, then puts the motor problem up to Welco.

You need never worry about such things as an unusual mounting position or requirement for large motor output with small motor space. You build the machine and Welco will make to your specifications the perfect motor to power it.

Write today for complete details

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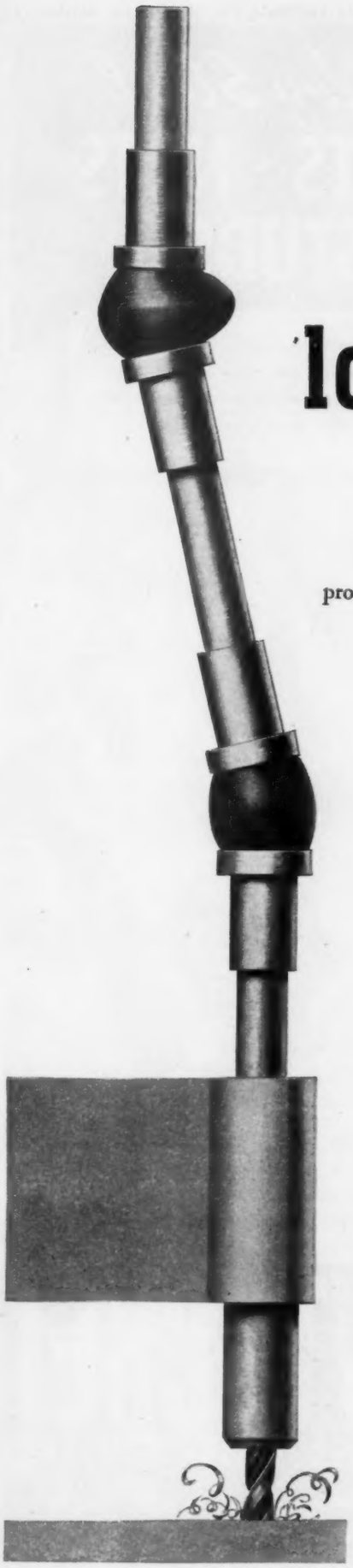

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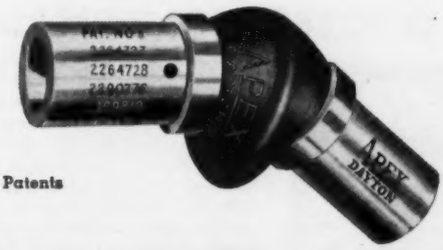
On adjustable multiple-spindle drills and other industrial applications, Apex industrial universal joints have proved, time after time, their ability to outlast ordinary joints—*in many cases as much as 6 times longer.* For good, sound reasons: Apex joints are hermetically sealed with lubricant-filled flexible covers. Foreign matter can't get in. Lubricant can't get out. Joints provide greater static and operating torque, highest shock load capacity, lowest deflection.

You can reduce the minimum spacing between drills by replacing with Apex joints *one size smaller—and still get longer service.* Sizes from 3/8 to 4 inches. Operating torque from 36 to 21,000 inch-lbs. Write Dept. A for Apex Joint "Data Rule" and bulletin 103.



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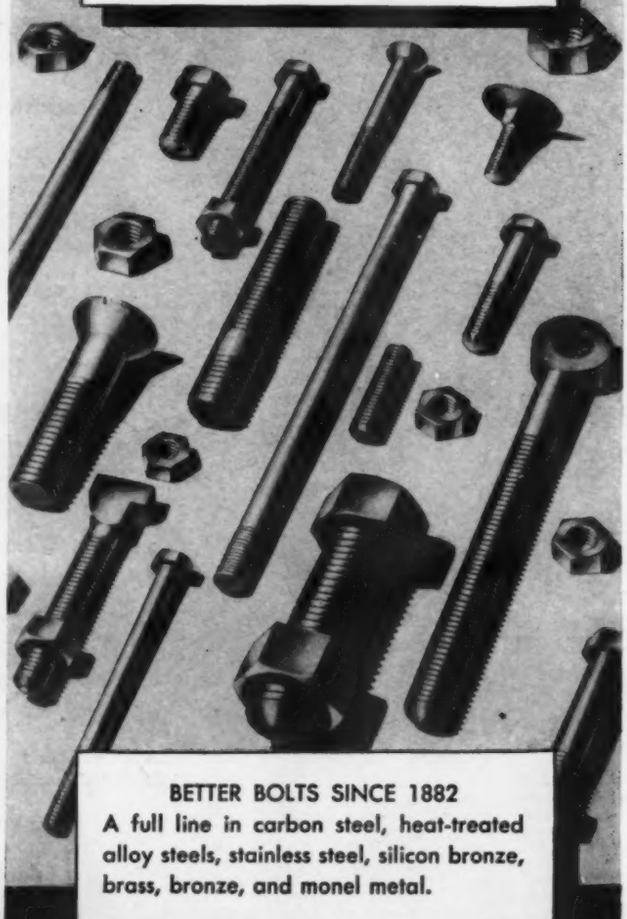

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KROPP

"FORGINGS TO EVERY SPECIFICATION"

ALLEN TRU-GROUND DOWEL PINS

support accurate tool and die work

They serve as locating pins for the diemaker's work — and then go on to general duty as pins and pivots in various machine assemblies. By their accuracy and strength they *retain* precision standards in tool and die assemblies under punishing stresses.

They are ground to a limit of .0002″ over basic size, with an allowable tolerance of plus or minus .0001″. Surfaces are finely polished; subsequently treated with a rust-preventive.

Metallurgically in a class with ALLEN Hex-socket Screws: — made of the same special-analysis *ALLENOY* steel, heat-treated to an extremely hard surface, with a core of the right toughness to prevent "mushrooming" when driven into a tight hole... Tensile strength, 240,000 to 250,000 lbs. per sq. inch... Typically the Allen high safety-factor in HOLDING-POWER.

Ask your local ALLEN Distributor for samples and dimensional data . . . the same Distributor who serves you dependably with Allen Hex Socket Screws and other first-call mill supply items.

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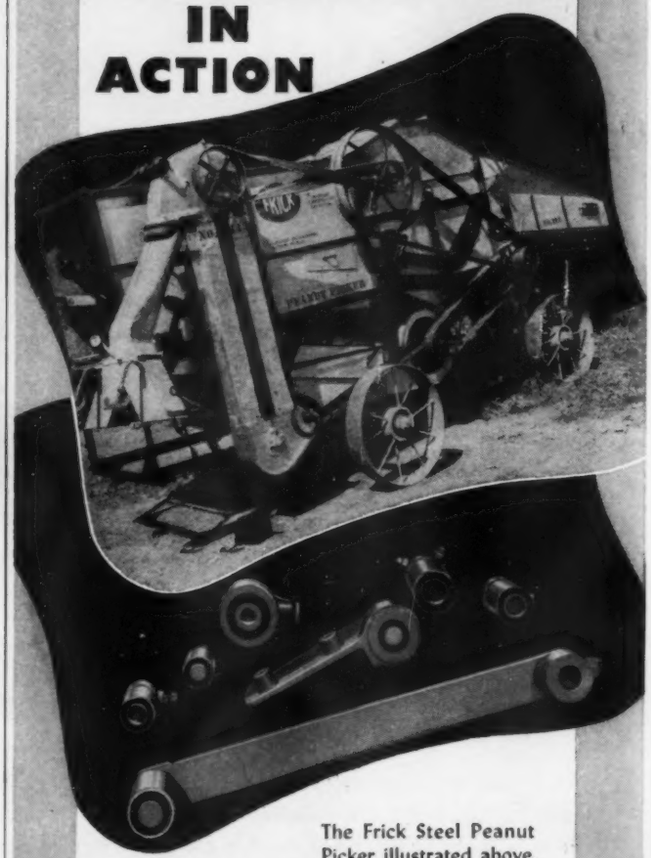
Torflex BEARINGS IN ACTION



The Frick Steel Peanut Picker illustrated above, uses 18 *Torflex* Bearings in various sizes for the ends of radius rods and pitman arms which actuate the screens.

Torflex Bearings are also used in other types of screen equipment, in rock and coal crushers and many other machines where the bearings are subject to dust conditions.

Torflex bearings require no lubrication, are practically without wear because there are no rubbing surfaces—they cushion shocks and absorb vibration. They are made in a wide variety of sizes and are applicable to all sorts of equipment.

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When you install Johnson QUALITY Bearing Bronze you get the highest quality available. You are assured of years of smooth, efficient bearing performance.

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Need extra GRIPPING POWER? Specify *Mac-its*

Mac-it **alloy steel square head set screws are milled from the solid bar with die-cut threads. Heat-treated for maximum torsional strength and to resist upsetting of the points.**

Mac-it Products Include: Socket Head Cap Screws, Hollow Set Screws, Hexagon Head Cap Screws, Square Head Set Screws, Stripper Bolts, Hexagon Socket Pipe Plugs.

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OUT OUR WAY
BY J. R. WILLIAMS
THERE'S THE OLD BULL CREASIN' HIS BROW AGAIN. HE SURE HATES TO SEE A MACHINE STANDIN' IDLE.
HE'S A GREAT GUY. NEXT THING HE'LL BE IN THE FRONT OFFICE NEEDLIN' THEM FOR A JOB FOR IT
J.R.WILLIAMS

No Let-Up for the Old Bull

The Old Bull's war job is over. He did it well. But . . . he realized he's got a bigger job ahead . . . the job of providing work for millions of servicemen as they come marching home. And . . . for the millions of home-front workers who did so much to bring peace. He knows idle machines don't create jobs so he's already needlin' the front office to rush plans that will keep every machine on the line hummin'. We at Ericsson are ready to help in any way possible.

(*Below*) Some of the many thousands of our precision parts that helped "Keep 'em flying and fighting."

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RUTHMAN
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COOLANT PUMPS

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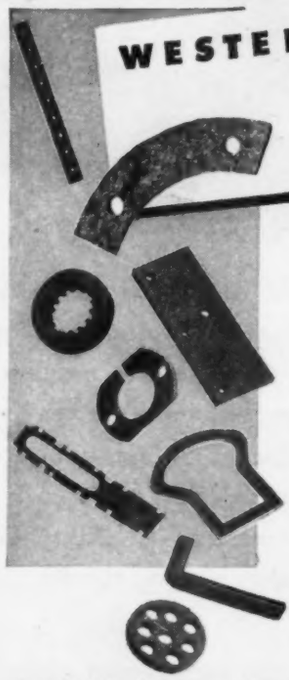
The "GUSHER"—A Modern Pump For Modern Machine Tools



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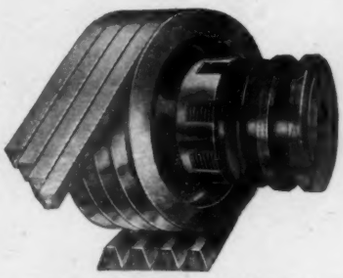
NO HEATING IN NEUTRAL WITH MAXITORQ FLOATING DISC CLUTCHES

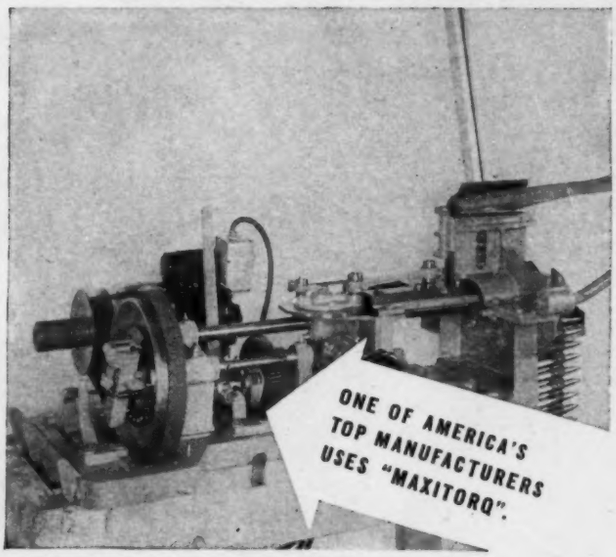
SINGLE CLUTCH

Maxitorqs are available in single and double types, wet or dry and in capacities from ¼ to 15 H.P. at 100 R.P.M. Larger Capacities to order.



PULLEY TYPE CLUTCH

Pulley type and Cut off Coupling types are also made . . . ¼ to 15 H.P. at 100 R.P.M. Ask our Engineers for recommendations to serve specific power transmission problems.



Pictured above is a packaging machine built by one of the country's leading manufacturers. They have found that the Maxitorq floating disc clutch fills all their requirements for positive and smooth power transmission . . . with the dependability of the machine itself. The "Who's Who" list of machine manufacturers using Maxitorq grows steadily. Our clutch specifications below show you why.

ASSEMBLE, ADJUST, TAKE-APART . . . *without* TOOLS

The simplicity of the Maxitorq is very evident when you take it apart (without tools). You will note the fine machining of each component . . . the ease and smoothness of fitting them together . . . the accuracy of adjustment.

Patented Maxitorq Separator Springs between each disc "float" them apart . . . prevent drag and abrasion in neutral . . . with no heating.

Engagement and disengagement are positive; controlled with light pressure. Construction of the entire unit is clean-cut, compact.

Carlyle Johnson has made clutches *only*, for over 40 years. The Maxitorq tops them all. It has all the characteristics to provide the finest, surest performance demanded by the most critical of machine tool and machinery designers.

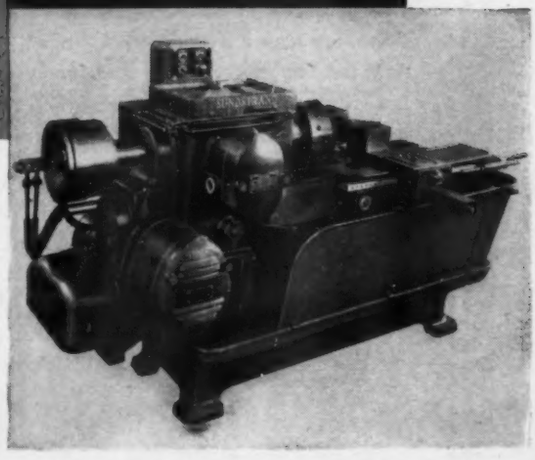
Specify Maxitorq for sure-action power transmission.

WRITE FOR CATALOG AM 21

TRADE MAXITORQ MARK

THE CARLYLE JOHNSON MACHINE COMPANY
MANCHESTER CONNECTICUT

Modern Machines Deserve Morse Drives...



Here Morse No. 50 Single Roller Chain permits simplified installation and the "Teeth not Tension" principle assures efficient, trouble-free operation. Driving from spindle, this chain moves the carriage, on the Sundstrand Model 12 Automatic Lathe. MORSE CHAIN COMPANY, ITHACA, N. Y., DETROIT 8, MICH.

MORSE ROLLER and SILENT CHAINS

SPROCKETS • FLEXIBLE COUPLINGS • CLUTCHES

NOW YOU CAN GET...

The Fast-Acting, Low Pressure, Economical Operation of... AIR

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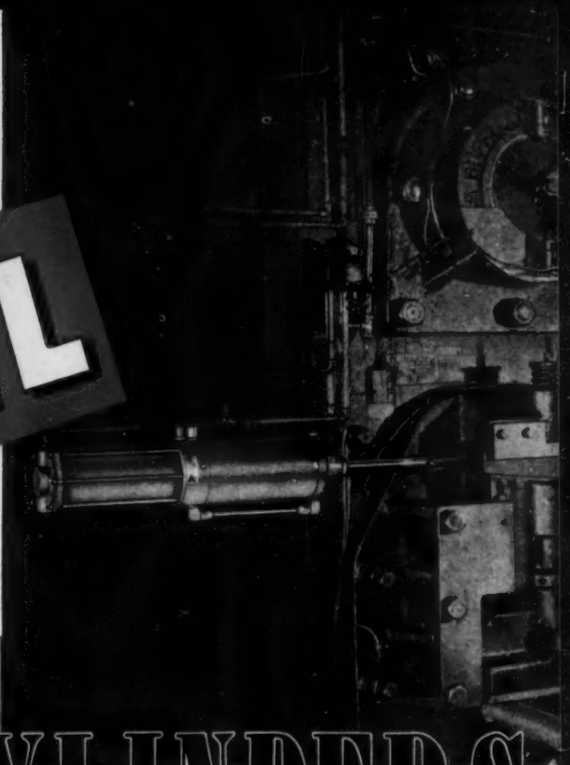

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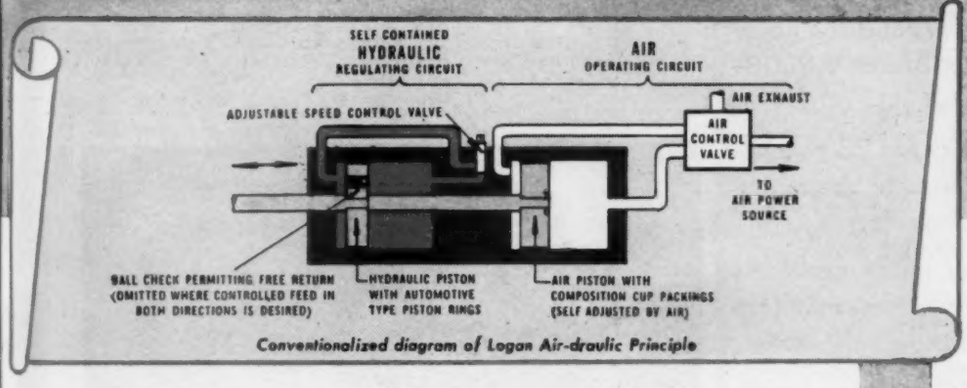
AIR-DRAULIC CYLINDERS


SELF CONTAINED HYDRAULIC REGULATING CIRCUIT
AIR OPERATING CIRCUIT
AIR EXHAUST
ADJUSTABLE SPEED CONTROL VALVE
AIR CONTROL VALVE
TO AIR POWER SOURCE
BALL CHECK PERMITTING FREE RETURN (OMITTED WHERE CONTROLLED FEED IN BOTH DIRECTIONS IS DESIRED)
HYDRAULIC PISTON WITH AUTOMOTIVE TYPE PISTON RINGS
AIR PISTON WITH COMPOSITION CUP PACKINGS (SELF ADJUSTED BY AIR)

Conventionalized diagram of Logan Air-draulic Principle

Powered by *AIR*... feed controlled in self-contained *HYDRAULIC* circuit (no power unit required)

For mechanical operations where accurate control of movements is essential and air operation is preferred, the new improved Logan AIR-DRAULIC Cylinders will give you far more uniform action than is possible with any ordinary air cylinder. Basically, AIR-DRAULIC Cylinders are *air cylinders*, and may be used wherever compressed air is available. Yet they provide the smooth, controlled feed which is normally obtained only in *hydraulic cylinders*.

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- Air cylinder is brass-lined steel tubing; piston has molded composition cup packings, self-adjusted by air.
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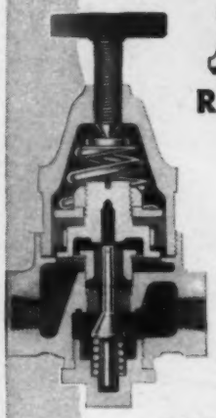

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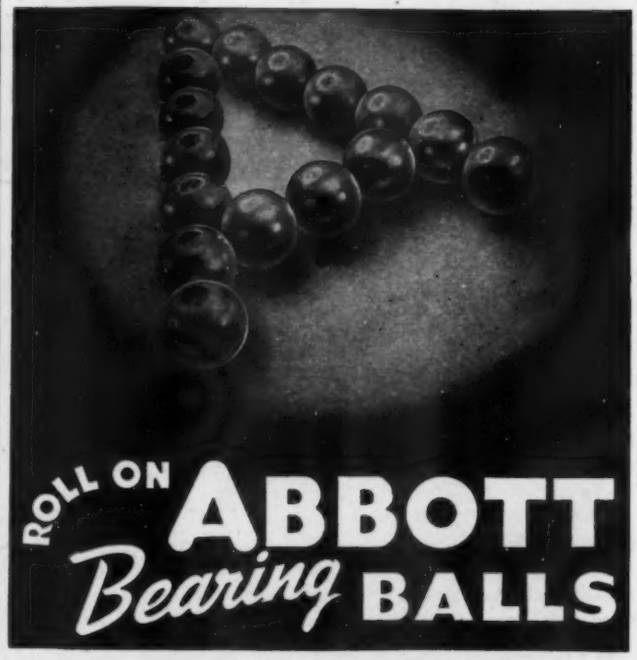

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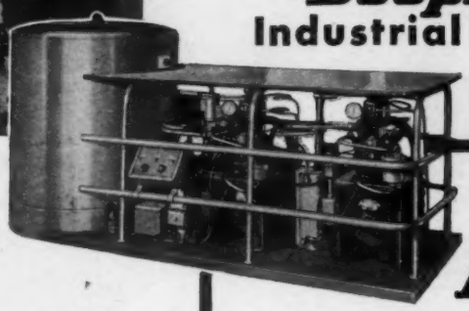

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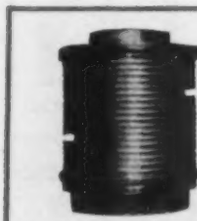

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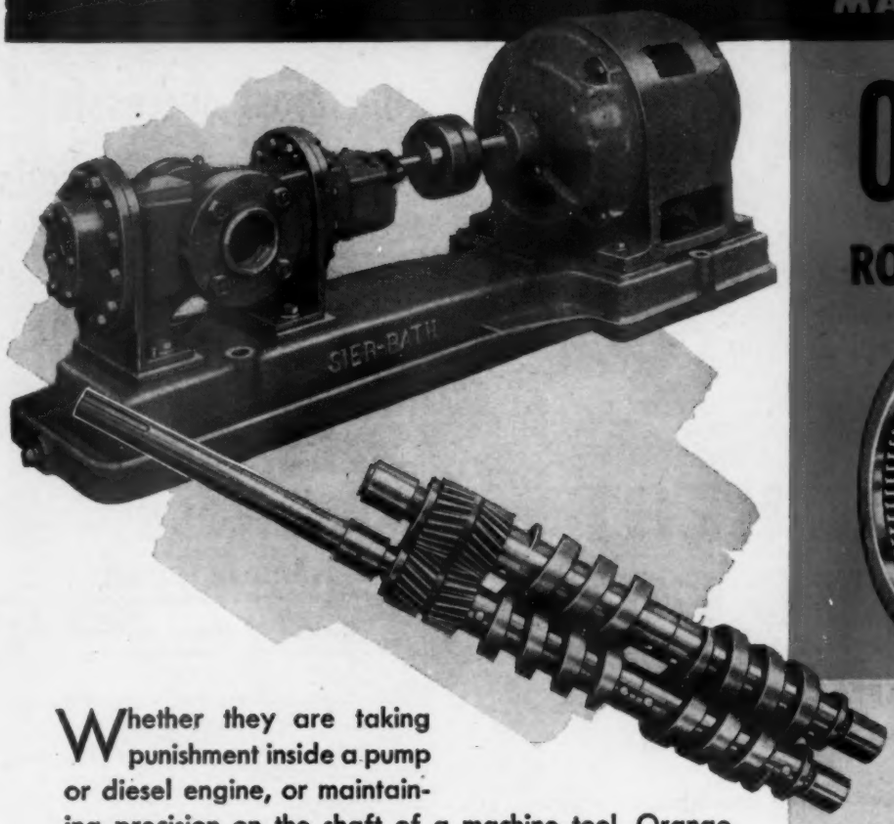

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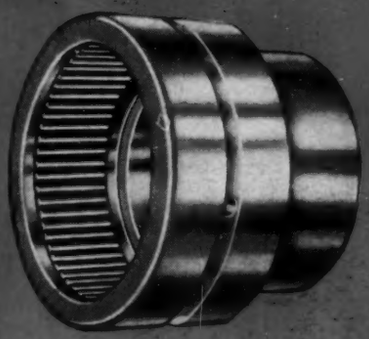

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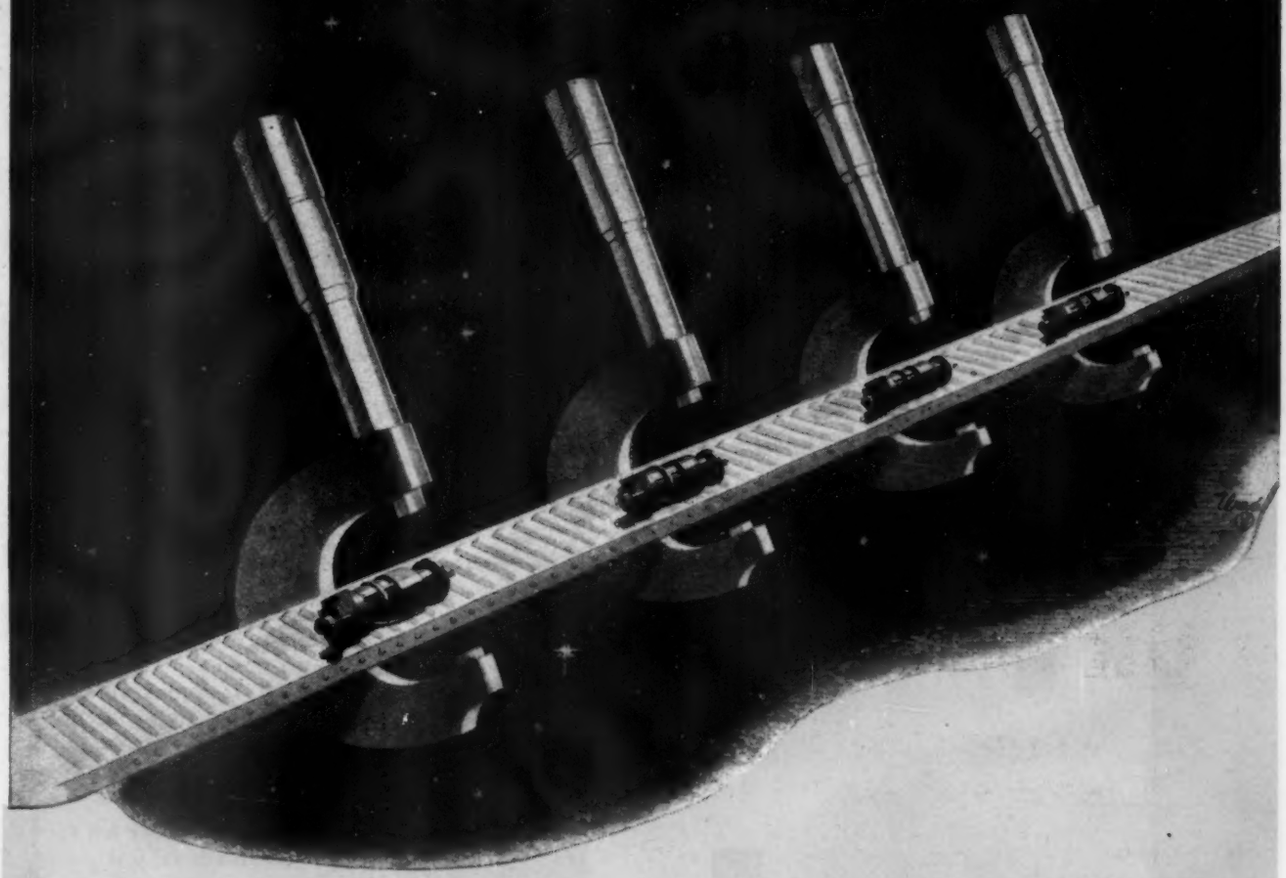

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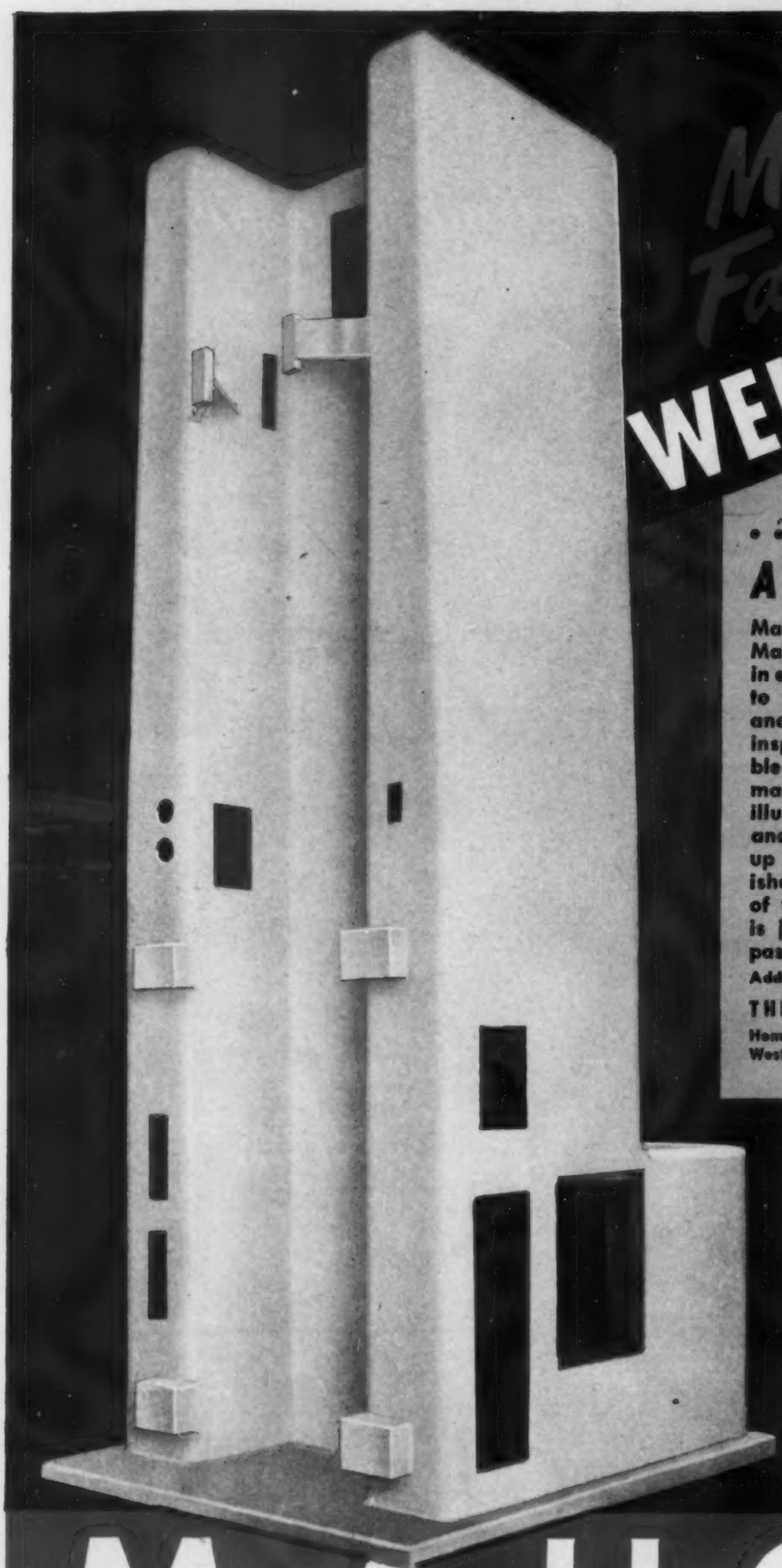

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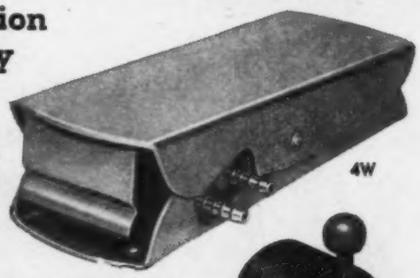

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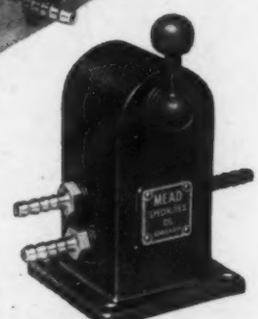

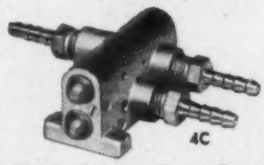

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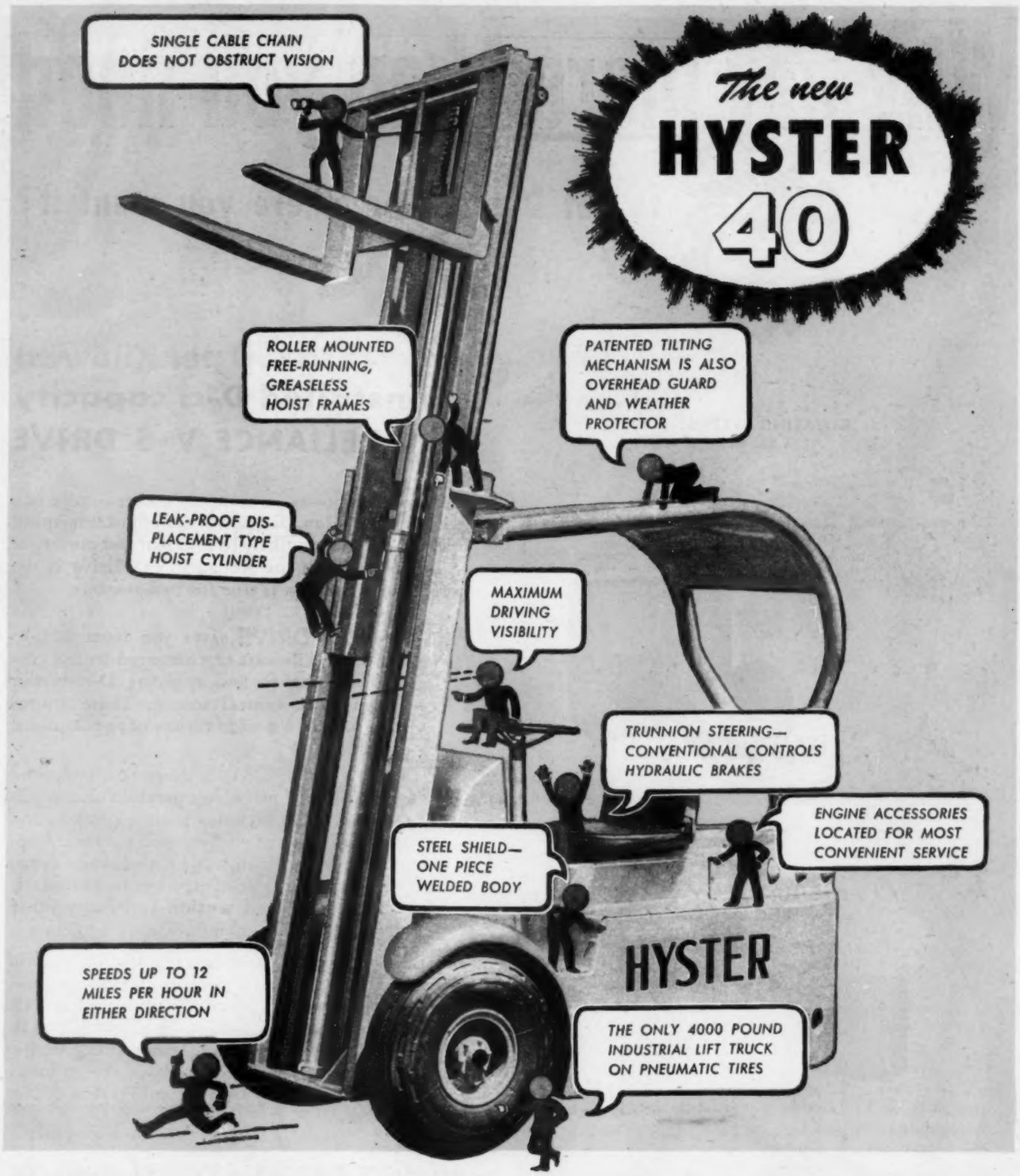
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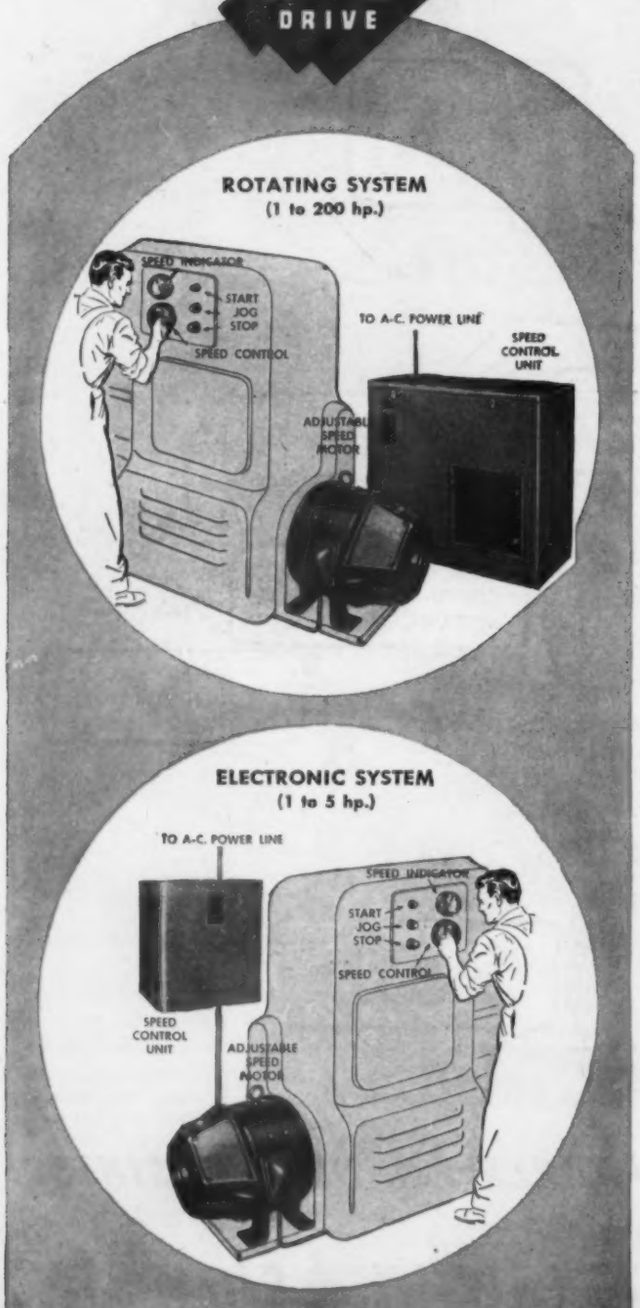

Save $25 to $60 per Kilowatt of installed D-c. capacity with RELIANCE V★S DRIVE

If in your plant—as in so many others—there is a need for supplying D-c. power for adjustable-speed operations, you are likely to find that *spot conversion of A-c. power* with the Reliance V★S Drive is the perfect answer. This is true for two reasons.

FIRST—V★S DRIVE saves you from $25 to $60 per kilowatt as compared to the cost of bringing in and applying D-c. power from some central source. These figures are based on a wide variety of applications.

SECOND—V★S DRIVE gives you unlimited flexibility of machine operation and application. This includes both automatic and manual control with smooth starting, stopping and reversing. Also, an infinite range of stepless speed changes, automatically maintained tension and many other specialized advantages.

Before installing D-c. power lines, learn what you can save with Reliance V★S Drive, which operates from your regular A-c. circuits. And see what V★S, with all-electric control, can do in improving quality and quantity of output, while reducing installation, operating and maintenance costs. Write today for the up-to-date story on spot conversion of A-c to D-c power.

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RELIANCE A-C D-C MOTORS

"Motor-Drive is More Than Power"

AEROMATIC AIRCRAFT PROPELLER DESIGN REVOLUTIONIZED WITH WALDES TRUARC RETAINING RINGS

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KOPPERS CO., INC.
Aeromatic Aircraft Propellers
RE: WALDES TRUARC RETAINING RINGS
✓ Maximum thrust load of 30000 lbs.
✓ Save at least 10% in weight
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✓ Hub threading, drilling and machining reduced to ring groove alone.
✓ Makes hub assembly self-locking
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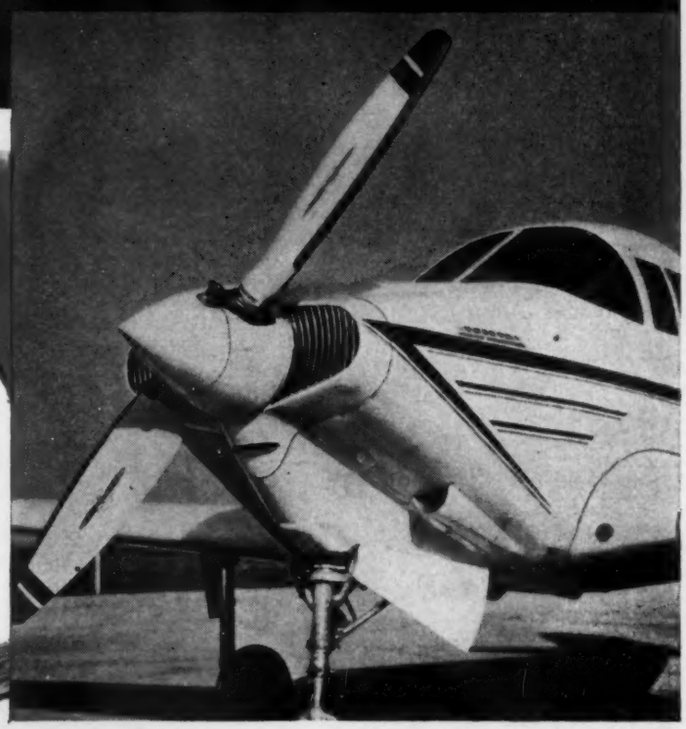
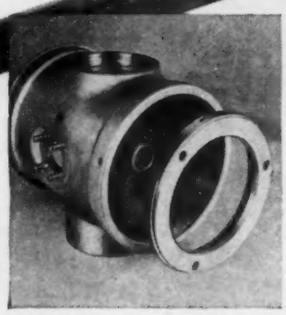


AEROMATIC AIRCRAFT PROPELLERS are standard equipment on the Rocket 185, illustrated above.

1

BEFORE TRUARC—

High centrifugal loads generated by whirling blades of automatic variable pitch propellers were borne by a buttress-threaded nut screwed into the hub. This meant expensive machining, extra weight.

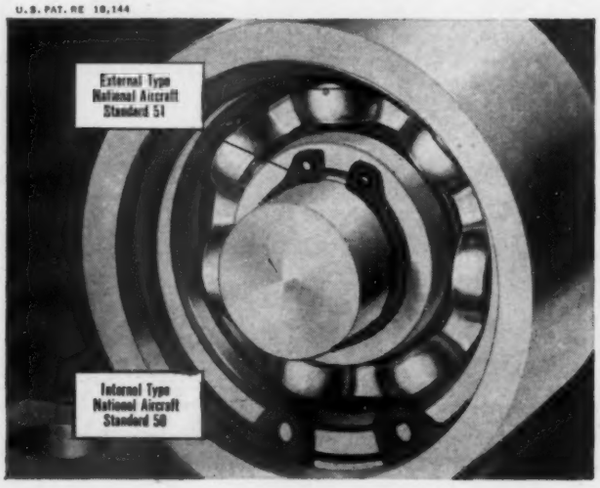


2

AFTER TRUARC—

Elimination of conventional nut greatly reduced weight—cut machining time and cost 75%—made overall maintenance easier. Truarc retention strength against tons of centrifugal force is 3 times greater than operating load.

U. S. PAT. RE 18,144



Waldes Truarc Retaining Rings are used to save weight, space, cost and time in a wide range of products. For holding and positioning machine parts they offer definite advantages over nuts, shoulders, collars and pins. They simplify and speed up production. They can be put on and taken off again and again—and still retain the perfect circularity which gives them their never-failing grip. Test them yourself. We'll furnish samples and complete data. Write Dept. B-2.

WALDES TRUARC TRADE MARK **RETAINING RINGS**

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CANADIAN REPRESENTATIVES: PRENCO PROGRESS CORP., LTD., 72-74 STAFFORD ST., TORONTO

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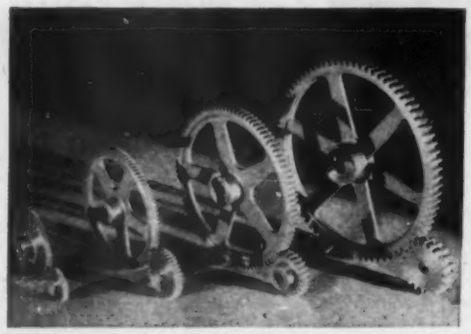
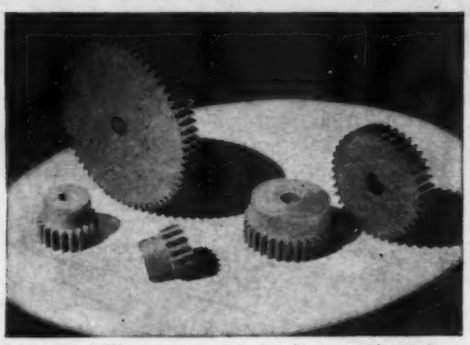
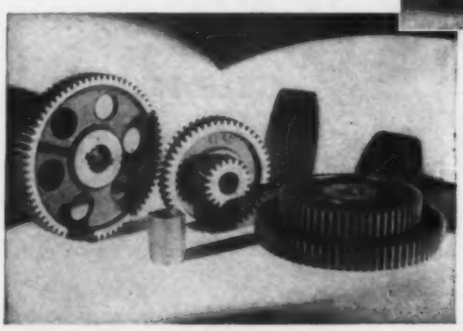
USE BOSTON STANDARD SPUR GEARS

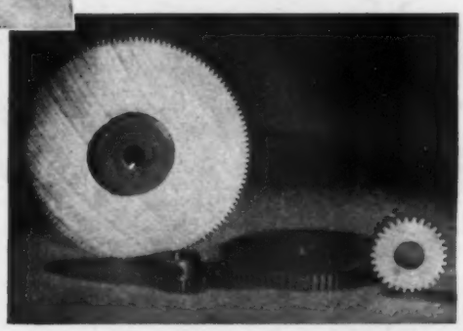


Brass spur gears in 48, 32, 24 and 16 pitch and in sizes from $\frac{5}{64}$" to 6" pitch diameter.



Non-metallic spur gears in diametral pitches from 16 to 3 and in sizes from $\frac{15}{16}$" to 6⅔" pitch diameter.





Iron and steel spur gears, 14½° pressure angle, in diametral pitches from 32 to 3 and in sizes from ½" to 40" pitch diameter; also 20° pressure angle in diametral pitches from 16 to 5 and in sizes from 1" to 36" pitch diameter.

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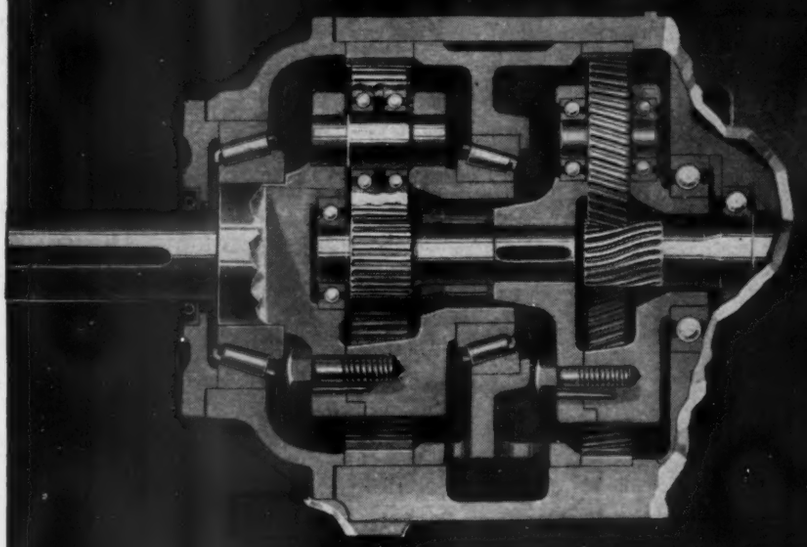

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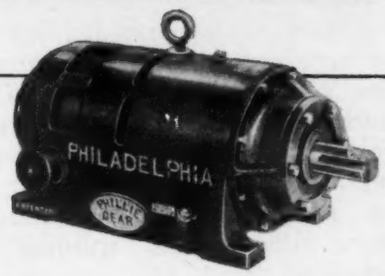
MOTOREDUCER



...Drive operates without Vibration

Both the horizontal and vertical MotoReduceR combine a motor and planetary speed reducer in a single housing. This results in an attractive streamlined effect that enables the MotoReduceR to blend with, and appear to be an integral part of any machine on which it is installed. More important though is the resulting better alignment of pinions and gears, which reduces noise and wear and conserves space. *Because there are no overhung parts, vibration is eliminated and proper tooth alignment is maintained at all loads.* All parts, however, are readily accessible.

The MotoReduceR will operate efficiently for years, without any attention except periodic changes of lubricant.

A wide range of sizes and ratios are available with standard A.G.M.A. ratings.

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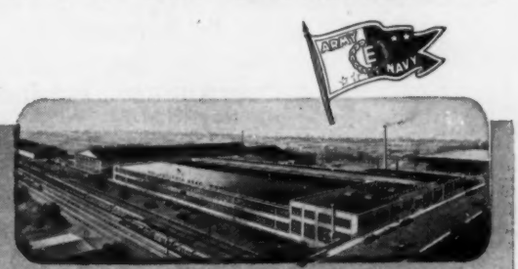

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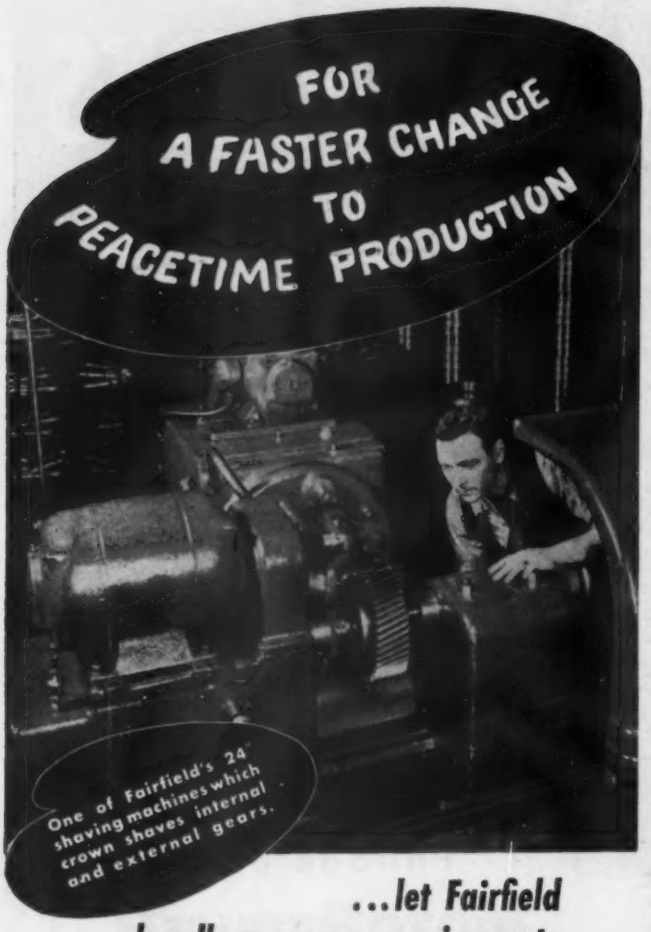
LimiTorque Valve Controls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One of Fairfield's 24 shaving machines which crown shaves internal and external gears.

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One way many plants are hastening the switch from wartime to peacetime production is to let Fairfield handle their gear production problems. Fairfield provides for them, and will provide for you, fast production of all kinds of gears, differentials, splined shafts and allied items.

At Fairfield there are the finest machines, enough of them for almost any production run, skilled machinists and an experienced engineering staff to relieve you of worry of producing these vital component parts. If yours is a gear problem, write to Fairfield for information. Ask for the illustrated brochure describing Fairfield's manufacturing facilities. There's no obligation.

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Sound, fundamental design? Long life? Dependable, low cost operation? Users have long recognized and expected these out-in-front features in Ohio Gear Speed Reducers. Now Ohio Gear takes another timely step forward, sets a new trend in speed reducers—attractive, modern appearance. Without any change whatever in basic engineering specifications such as center distances, shaft dimensions, mounting arrangements, etc. each series in the entire Ohio Gear Reducer family has been visually redesigned. This offers new avenues of opportunity to engineers seeking to step up and modernize the appearance of their products.

Availability? Though still extremely limited, production is being increased as fast as possible and deliveries are being scheduled at the earliest date consistant with production facilities and the availability of materials.

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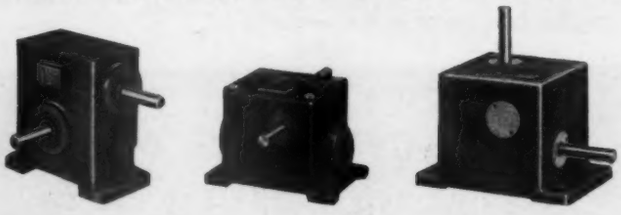

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OHIO GEARS

Falk Motoreducers are available in a number of models, of various sizes and ratings, with single, double, and triple reduction gear sets. Illustrations show, above, double reduction all-motor type DU, and, at right, double reduction vertical all-motor type DZX. Both are available in 1 to 75 horsepower range.

Falk is the only manufacturer of the all-motor type of motoreducer. This type permits use of any make of motor in both horizontal and vertical models.

ANY SIZE: for continuous or intermittent service, and for steady variable, or shock loads. Falk Steelflex Couplings are included to provide torsional resilience between motor and gears. Available for floor, wall, or ceiling mounting, with a variety of arrangements providing 16 possible assemblies.

ANY SERVICE: Falk Motoreducers are widely used for mixer drives, agitator drives, conveyor drives, pump drives, dust collector drives, screen drives, classifier drives, shot blast drives, vat drives, fan drives and washer drives.

ANY HORSEPOWER: made to accommodate any standard motor from 1 to 30 H.P. on single reduction horizontal or vertical units; from 1 to 75 H.P. on double reduction units; and 1 to 40 H.P. on triple reduction units.

ANY SPEED: gear sets are available for almost any speed from 1430 to 280 rpm on single reduction units; 230 to 45 rpm on double reduction units; and from 37 to 7.5 rpm on triple reduction units, either horizontal or vertical type.

ANY TYPE: any type Falk Motoreducer is available in any speed and horsepower rating range; that is, the single reduction Motoreducer in any particular rating is available in both horizontal and vertical all-motor types. See other horizontal and vertical types illustrated at right.

ANY MOTOR: any standard horizontal ball bearing motor with feet may be used on the horizontal all-motor reducers; any standard vertical type motor on the vertical units.

IT ALWAYS PAYS TO CONSULT **FALK**

Motor-changeability!

A feature of Falk Motoreducers which makes them adaptable to any requirement

Falk All-Motor units are the answer to the man who prefers to use a motor of his own selection with the gear drive. For Falk All-Motor units make it possible to interchange motors or units, in the plant, on the job, in a few minutes time.

With Falk All-Motor units, illustrated on the left-hand page, you can use any make, speed, or type of motor required, within the rating of the unit. You can interchange motors from one line to another, or from one part of the plant to another. Few spare motors are necessary.

Falk Motoreducers are compact, self-contained unit drives available in either horizontal or vertical models, in horsepower ranges of from 1 to 75 H.P., and with single, double, or triple reduction gears giving an output range of from 1430 down to 7.5 rpm.

Parts as well as motors are fully interchangeable, and you can keep spare parts stocks with the knowledge that they will fit closely without plant machining. That is because of the close tolerances which Falk precision workmanship holds on these parts. Shafts are machined to a tolerance plus of .0000", minus .0005"; tolerance on gearing to within .0001" per inch of face on lead. Profile accuracy of tooth is within .0002".

Gear ratios are quickly and easily changed at little cost. There are no parts requiring adjustment. Absolute freedom from oil leakage is characteristic. Operation is quiet, with reducer efficiencies 98% on single reduction units, 97% on double and triple reduction. A Falk Steelflex Coupling takes care of any possible misalignment and provides torsional resilience between motor and gears.

Single Reduction Motoreducers
Above: horizontal type LU.
Right: vertical type LUX

Double Reduction Motoreducers
Above: horizontal type DU.
Right: vertical type DZX

Triple Reduction Motoreducers
Above: horizontal type RZ
Right: vertical type RZX

Gears are made of high grade Falk gear steel, or, on the larger units, Falk Telastic Molybdenum steel. All gears are heat treated to 285-330 Brinnell, then cut and shaved. Bearings are ball or straight or taper roller, with oversize bearings on low speed shafts to permit heavy overhung loads and thrust loads. Lubrication is through an automatic continuous system of Falk design, multi-sealed to be completely leak-proof. A special pressure system is built into Falk vertical Motoreducers.

Write Falk for Bulletin 3100, which gives details and specifications, and complete selection tables for all Falk Motoreducers for any service. It also contains load classification tables for common applications.

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For over fifty years precision manufacturers of Speed Reducers . . . Motoreducers . . . Flexible Couplings . . . Herringbone and Single Helical Gears . . . Heavy Gear Drives . . . Marine Turbine and Diesel Gear Drives and Clutches . . . Steel Castings . . . Contract Welding and Machine Work.—District Offices, Representatives in principal cities.

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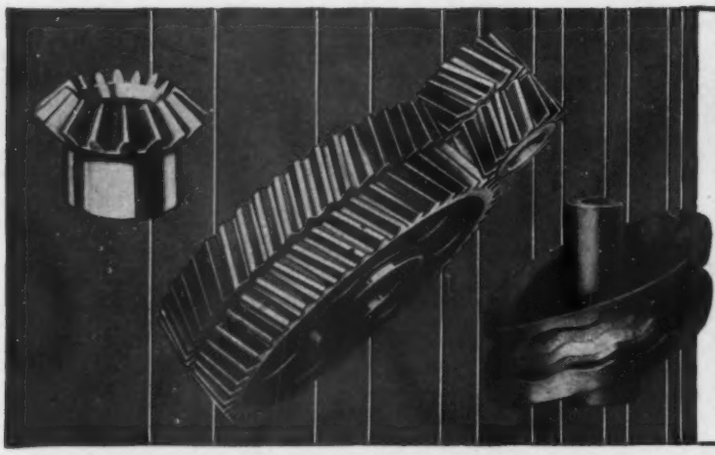

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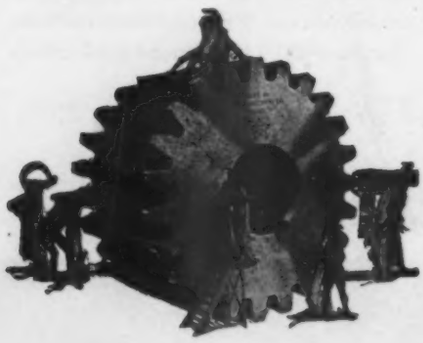

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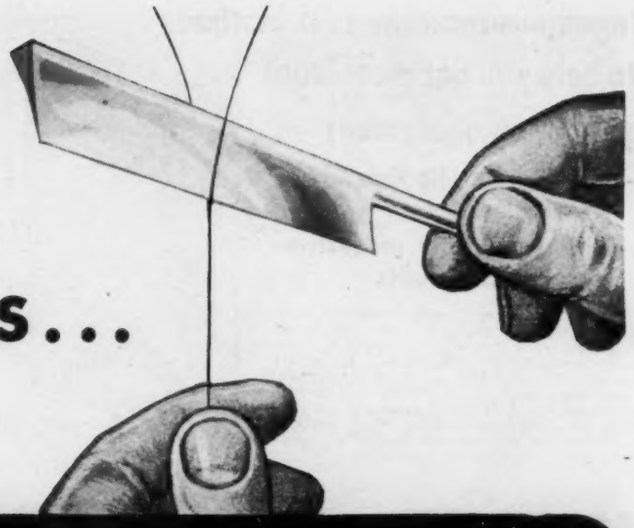
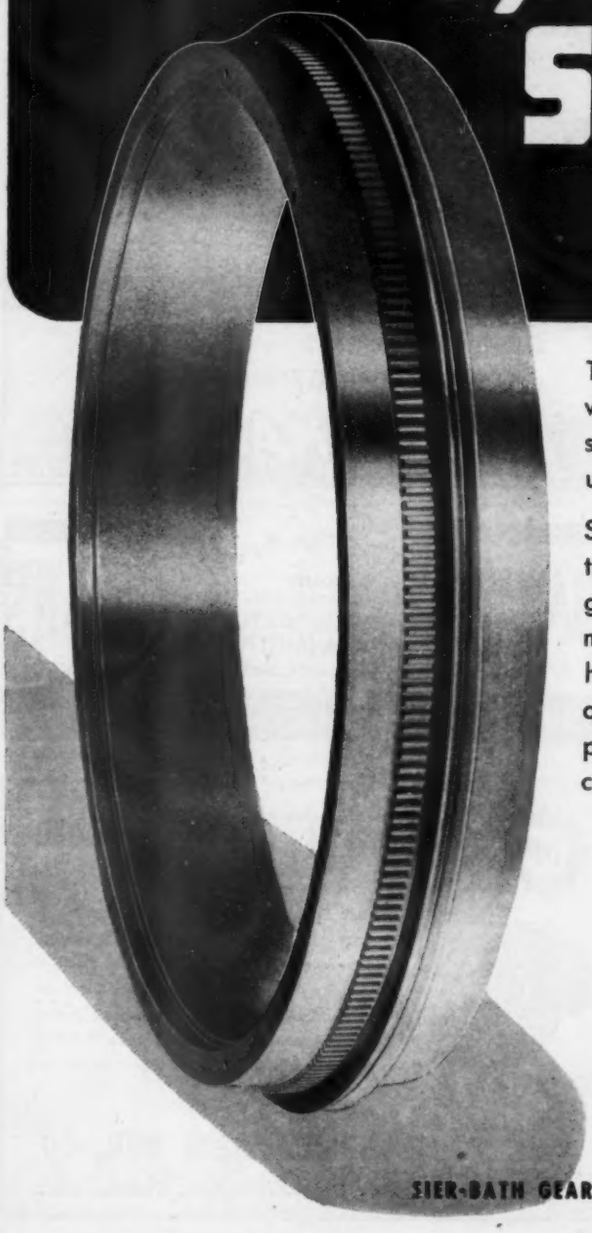


Specify SIER-BATH GEARS



The Vee groove and teeth of the spur gear shown here were held within .0005" relationship in tough stainless steel throughout long runs. That's real dimensional uniformity!

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Sier-Bath Gear Co. Inc.

SIER-BATH GEAR COMPANY, Inc., 9248 HUDSON BLVD., NORTH BERGEN, N. J.

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—to cut down idle time of machines

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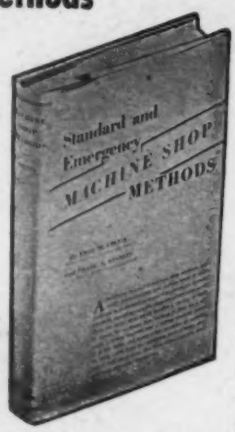

This manual of machine tool methods gives both standard practice and also many ingenious substitute uses developed to meet war production emergencies. It covers many different jobs in turning, boring, and other operations, giving full details of actual cases in which time and trouble, and even complete hold-up of production, was avoided by applying machines to jobs they were not intended to handle.

STANDARD and EMERGENCY MACHINE-SHOP METHODS

By FRED H. COLVIN
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333 pages, 5½x8½, fully illustrated, $3.50

Here is a mine of ideas for any machinist, in devising methods for handling difficult or unusual jobs. More than this, by showing scores of usable and adaptable ideas for using machines in different ways, the book gives invaluable aid to the shop owner and operator in saving production time when the normal machine for the job is laid up, busy, or otherwise not available, and in profitably increasing the variety of work handled by his shop.

Look up—

- —using multiple tools
- —building special machines from standard units
- —boring on the radial drill
- —mounting drills upside down
- —using weights for feeding spot-facing tool
- —turntable fixture made from old flywheel
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- —emergency boring fixtures
- —milling on a boring machine
- —gear cutting on a horizontal boring machine
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See it on approval

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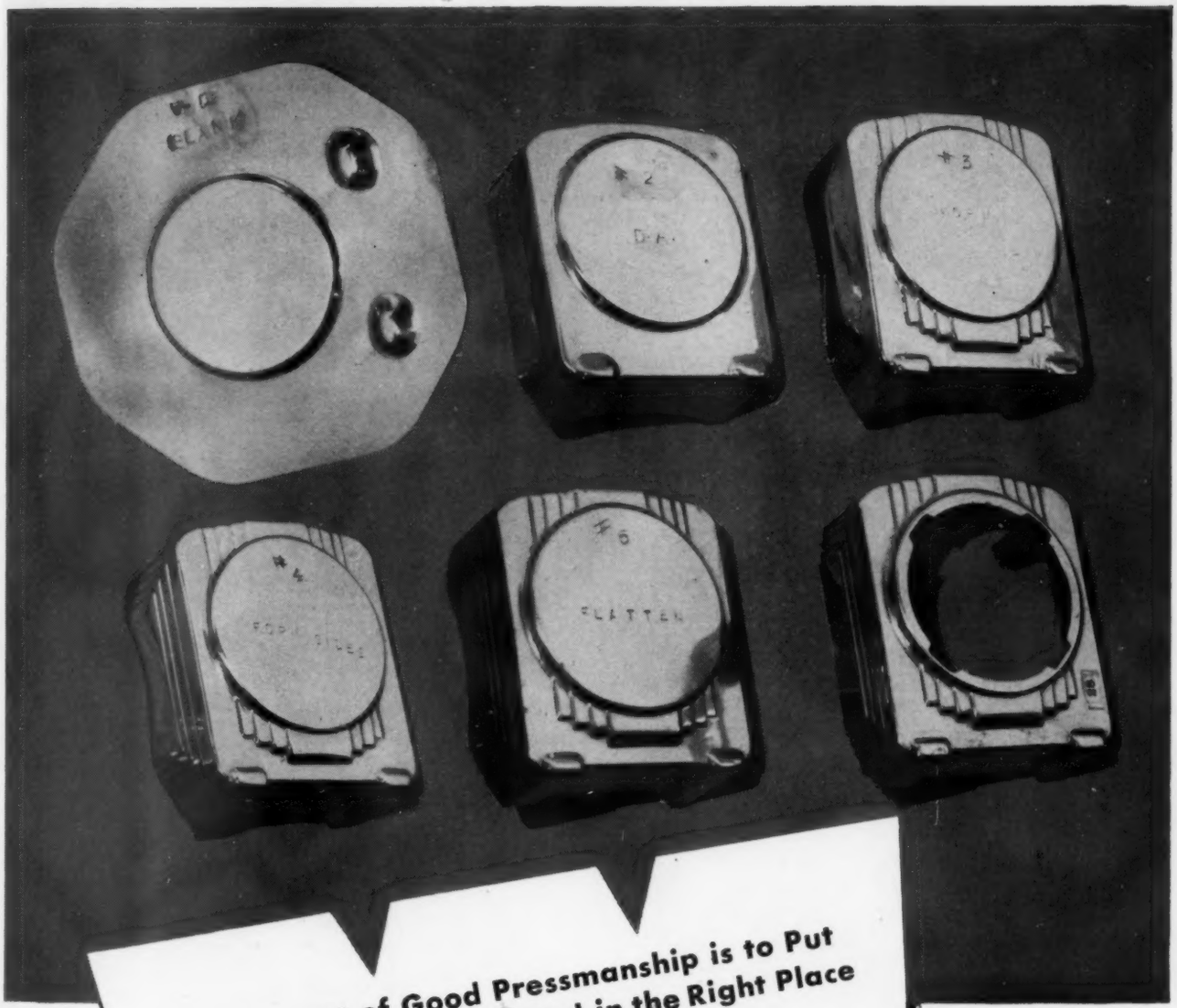


The Secret of Good Pressmanship is to Put the Right Amount of Metal in the Right Place

At first glance, this alarm clock case has little to distinguish it from dozens of other cases we have made. However, the secret of successfully drawing this 6-oz. blank is in having extra amounts of metal available in the right place. And in correct quantity; too much would cause wrinkling—too little, spoilage . . . In stamping metal only .025" thick, we admit it is difficult to stretch and thin to any extent without cracking . . . Note in the first operation shown above how this extra metal has been placed in the blank to provide for the decorative legs and the rim prongs needed for the clock assembly . . . Stamped metal cases are thinner and lighter than plastics — will not warp or crack if dropped . . . Unquestionably, Presteel engineers can help you with some of *your* production problems.

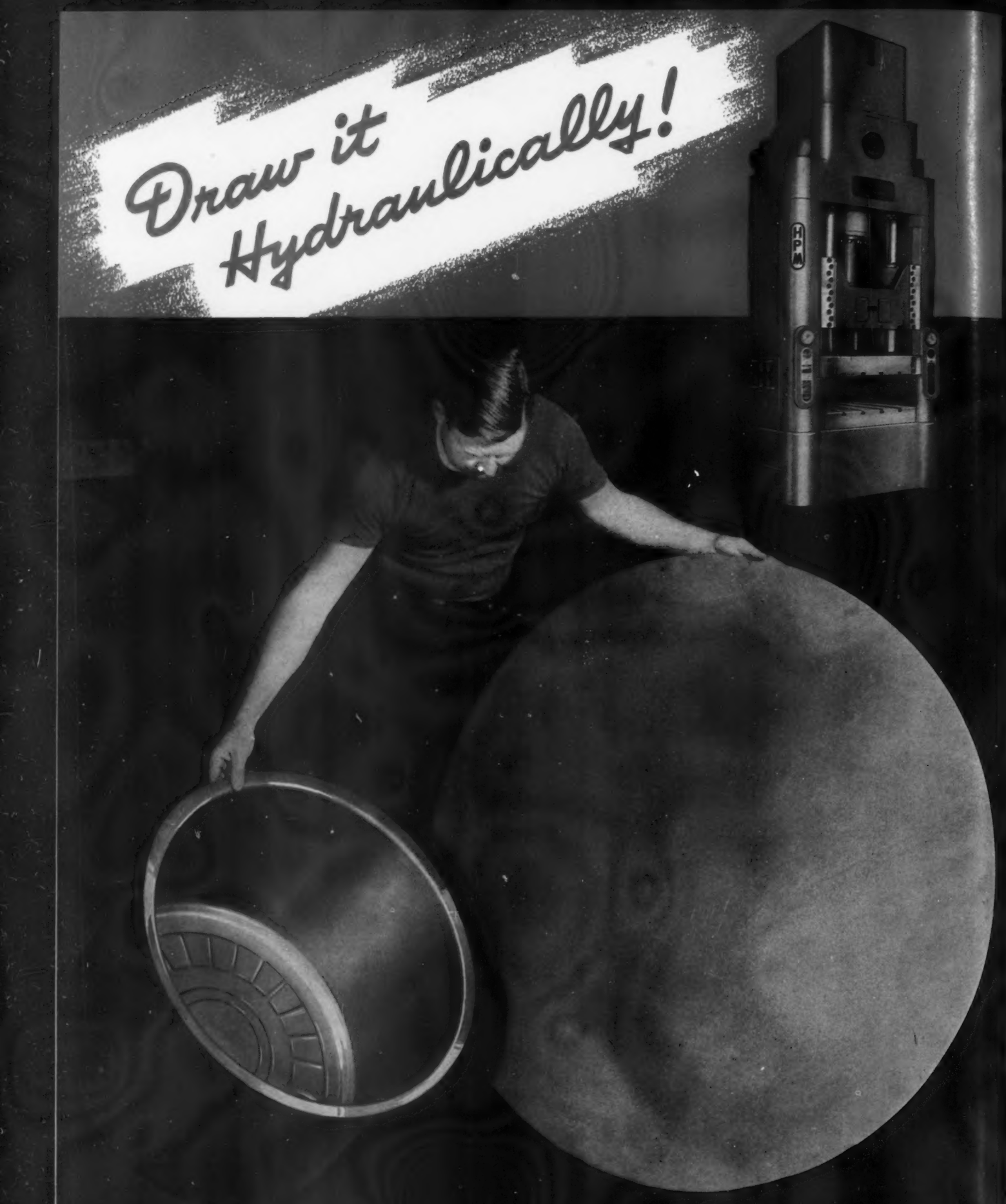
WORCESTER PRESSED STEEL CO.

202 Barber Avenue *Worcester 6, Mass.*

ALLOY STEELS AND OTHER METALS COLD FASHIONED SINCE 1883

Representatives in Alexandria Virginia, Buffalo, Canton Ohio, Chicago, Denver, Detroit, Fort Worth, Indianapolis, Los Angeles, New York, Philadelphia, Syracuse, Toronto

Draw it Hydraulically!



Above is illustrated the results of a single draw in an H-P-M press installed in the plant of Benjamin Electric Company, Des Plaines, Illinois. Blank size — 44" dia. (19 gauge steel). Tub size — 23" dia. x 15-5/16" deep. Production averages 100 tubs per hour. Die cushion pressure embosses bottom of tub at start of draw, eliminating the need for additional embossing operations.

A COMPLETE WASHING MACHINE TUB IN ONE DRAW !

The best way to reduce your metal working costs is to reduce the number of drawing operations. This not only speeds-up production, but greatly reduces your manufacturing overheads . . . fewer dies, less press equipment, smaller factory space and less manpower. In a majority of cases where deep sheet metal drawing operations are involved, H-P-M "All-Hydraulic" presses will permit you to draw parts with fewer operations, and at the same time keep rejects to a minimum.

The H-P-M FASTRAVERSE press has great versatility of control, permitting the press to be easily and quickly adjusted to meet the specific requirements of each draw job. Absolute control of the drawing speed at a constant value, plus total elimination of high impact stresses guarantees proper metal flow. Independent pressure control of each hydraulic action . . . punch carrying slide, blankholder and die cushion, provides just the right tonnage for each job.

Automatic reversal of the press at a predetermined pressure insures uniform results, and protects both dies and press. The fact that maximum pressure can be secured at any point within the limits of the press stroke greatly increases the scope of operations. Investigate these revolutionary "All-Hydraulic" production units. Draw your sheet metal parts hydraulically.

The Hydraulic Press Mfg. Co.

Mount Gilead, Ohio, U. S. A.

Branch Offices in New York, Philadelphia, Cleveland, Detroit, and Chicago. Representatives in other principal cities.

REVOLUTIONIZING

HPM

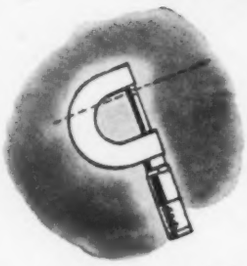
All-Hydraulic

FASTRAVERSE PRESSES

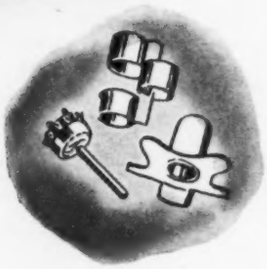
PRODUCTION WITH HYDRAULICS SINCE 1877

How FEDERAL PRESSES

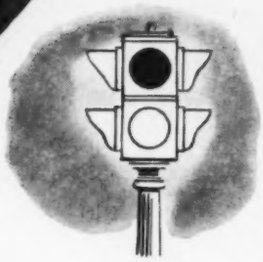
HIGH SPEED



ACCURACY



VERSATILITY



SAFETY

eliminate the need for SPECIALIZED MACHINERY

Factual records show that the advanced Federal Presses are performing an increasing variety of metal-working jobs never before regarded as press operations — producing hundreds of special items which formerly required expensive specialized machinery of limited utility. Thanks to their remarkable versatility and accuracy, Federals not only handle with ease the secondary operations common to ordinary presses, but primary and assembly work as well; in some cases perform intricate combinations of all three! Moving parts are completely enclosed — providing safety for operator, eliminating confusion, and increasing production speeds. In fact, Federal Presses are rightfully famous for precision work — saving time and manpower, reducing costs as well. Write today for latest catalog of the complete Federal line.

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Need Answers about Shearing Stainless?

Shear Blades?
What tolerances are recommended on blades for shearing E-S Type 304 Stainless? Can we use the same blades on E-S Type 316?

Fine Perforating?
What is the smallest diameter hole that can be accurately punched in 30-gage E-S Type 302 sheet, and what is the minimum spacing that will not tear between perforations?

Clearance for Blanking?
What die clearance should we use for blanking 6-in. circles in No. 7-gage E-S Type 410 plate?

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In slitting and drawing small louvres in E-S Type 321 Stainless, the metal sometimes strings across the slit. How can we overcome this?

Die Changes?
Will E-S Type 430 break out when stamped? Can we use the same dies in stamping E-S Type 430 that we use in stamping E-S Type 347?

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After spinning E-S Type 304 bowls, we want the edge soft enough for trimming and corrugating, without a second anneal. Is this possible?

ask Eastern for the answer when Stainless is the question

Questions like these are "duck soup" at Eastern. Many of the answers are given in the big new catalog, "Eastern Stainless Steel Sheets," but if you have a specific question about cutting or shearing Stainless, be sure to ask Eastern...where your inquiry is welcome. JMLCo-E-B1

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STEEL CORPORATION
BALTIMORE 3, MARYLAND • Distributors' stock available in most areas
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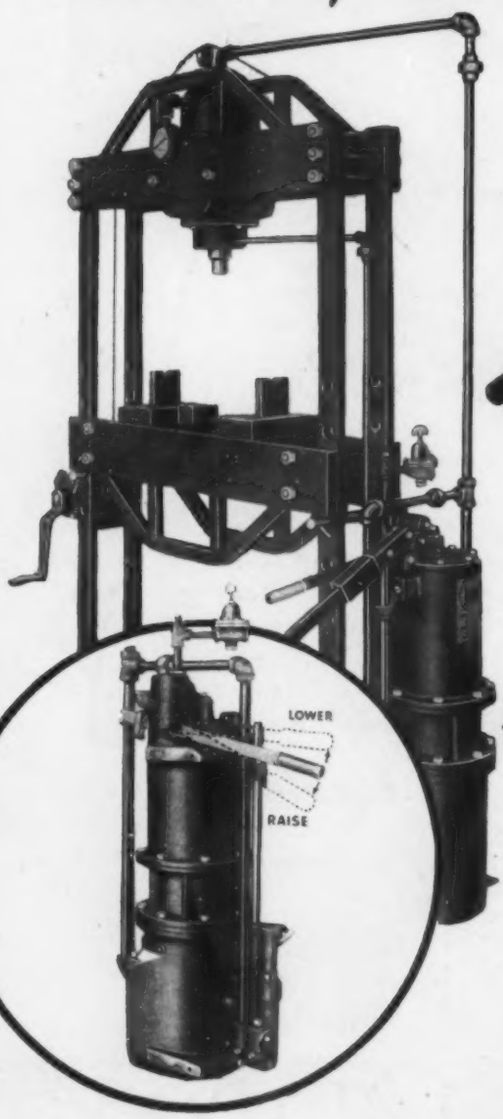
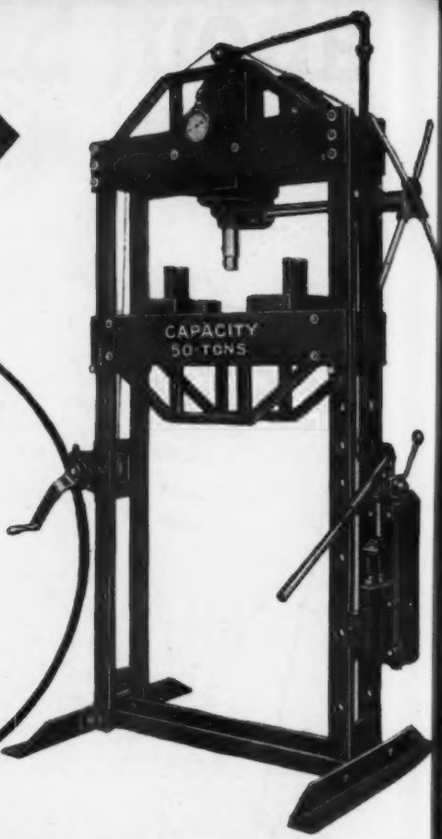
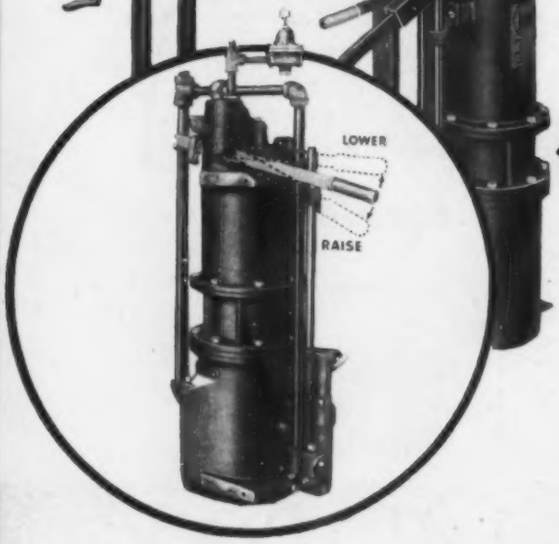
WE BUILD PRESSES

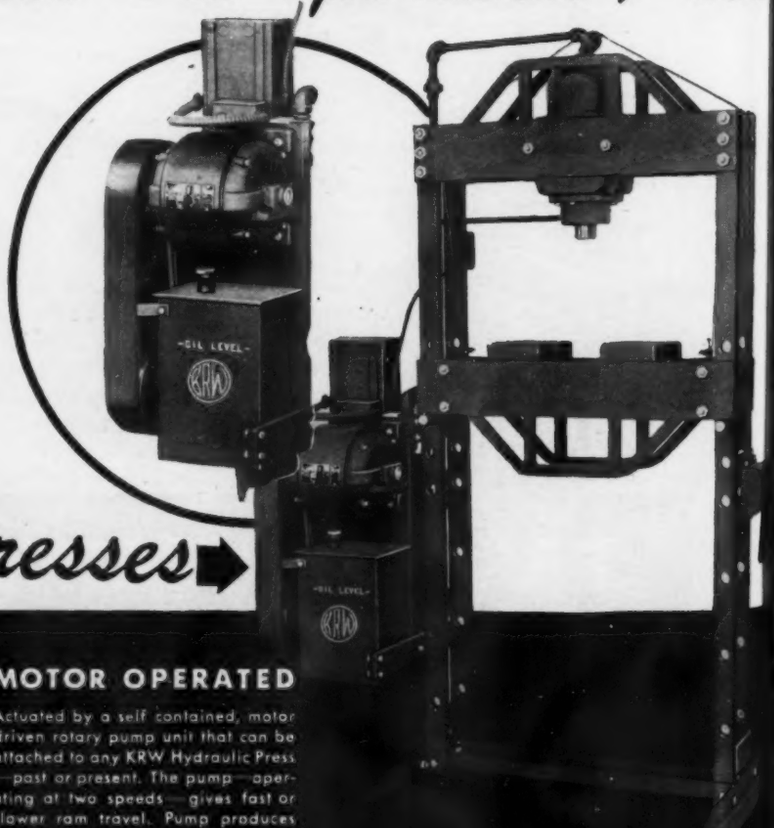
Hand Operated Presses





Air-Oil Operated Pres





Motor Operated Presses

HAND OPERATED

More power with less effort—faster ram travel with a quick-acting finger-controlled valve combine to make this pump outstanding in hydraulic action. Twin pumps enable operator to vary ram speed. Only KRW offers this advantage.

AIR-OIL OPERATED

Equipped with the KRW "Speedi-Booster" Operating with compressed air, these hydraulic presses provide tons of pressure on the ram by simply raising or lowering the operating lever—no effort required. Ram tonnages are dependent on initial air pressure and size of air and oil cylinders.

MOTOR OPERATED

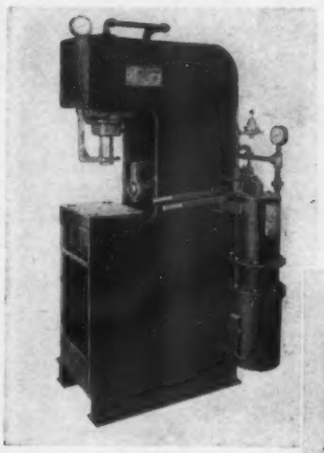
Actuated by a self contained, motor driven rotary pump unit that can be attached to any KRW Hydraulic Press—past or present. The pump—operating at two speeds—gives fast or slower ram travel. Pump produces 1000 lbs. per sq. in. pressure with 10 to 15-ton ram pressure depending on diameter of ram cylinder.

S TO SUIT YOUR JOB

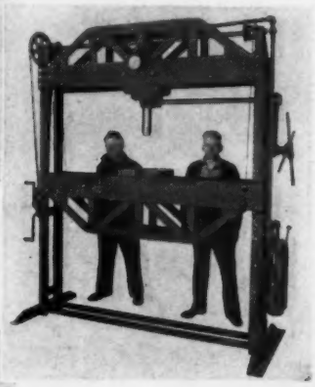
KRW HYDRAULIC ARBOR PRESSES

CAN BE ENGINEERED TO YOUR PARTICULAR PRODUCTION PROBLEM

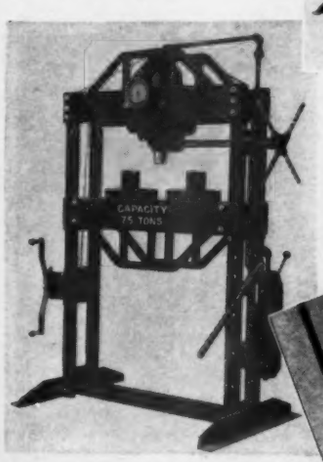
With prompt delivery assured



A Gap Press with independently operated cylinders providing pressure downward and horizontally.



A special 75-ton hand-operated press measuring 72" between uprights. Bed is adjustable from minimum of 4" to maximum of 6'.



The "Stubby 75", a compact 75-ton hand-operated press designed for concentrated loads and built to users specifications.

● **The old conception of an arbor press is as different from the modern KRW Hydraulic Arbor Press as day is from night . . . now they are built in innumerable shapes and adaptations to work on literally hundreds of production jobs. They are available as speedy Hand Operated Presses; highly flexible Air Operated Presses or as versatile and effortless Motor Operated Presses. Then too, they are built in almost any conceivable physical form . . . tall, short, narrow, vertical or horizontal standing, as gap presses, forming brakes and many other designs. Mass production in a modern plant keeps KRW prices at rock bottom and quality at the highest possible peak. The new KRW illustrated 32-page Press Catalog is full of valuable information and suggestions on how others have saved time and money with some form of KRW Hydraulic Press. Mail the coupon for your copy now.**

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Please mail me a copy of your New Hydraulic Arbor Press Catalog.

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11

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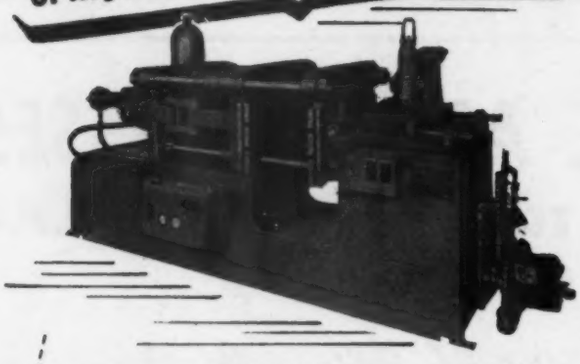
KUX Produces the Most Complete Line of High Pressure Die Casting Machines



A size and model for every individual die casting need. 15 different types and sizes. Air operation or self-contained hydraulic operation. Automatic electrically timed casting cycle. Bullet-speed metal injection for densely consolidated castings. Safe, massively strong die plates and toggle mechanism.

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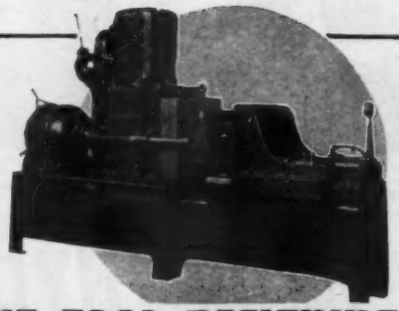

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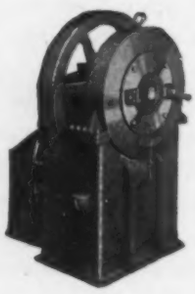
ESTABLISHED 1906



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— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

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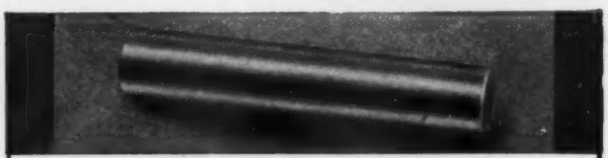

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A CENTERED EYE IN 1 OPERATION

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The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at high hourly production rates. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

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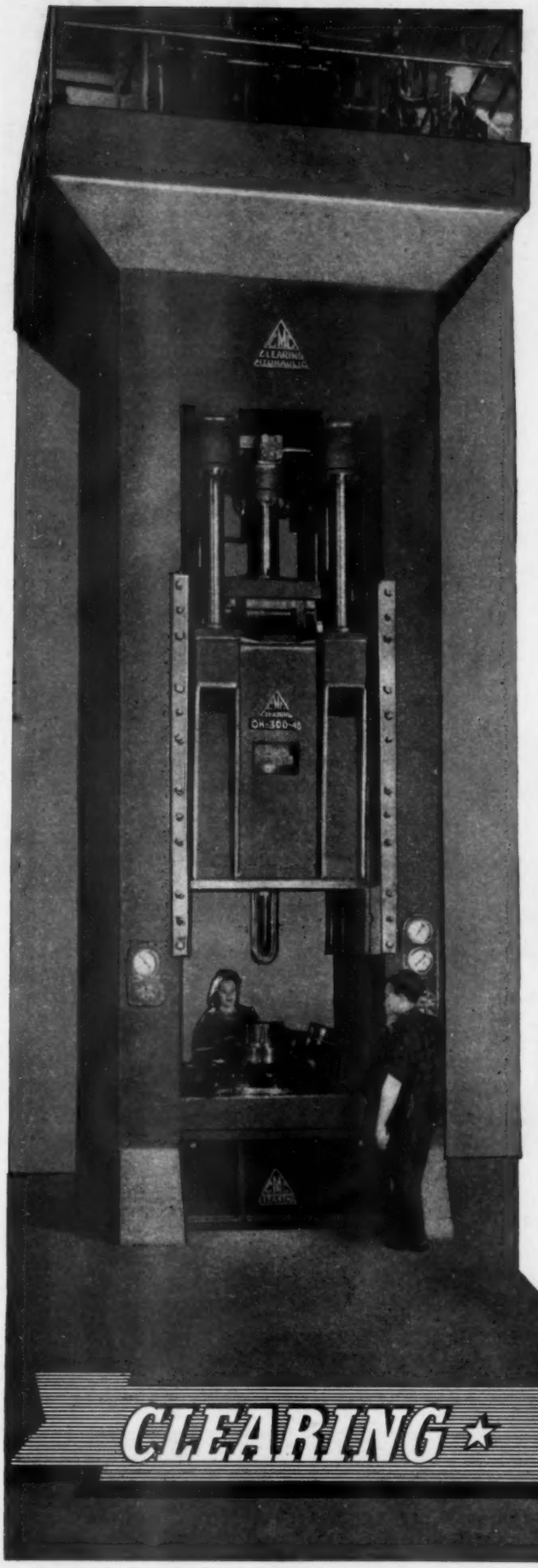

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To Meet Rigid Specifications

True test of the soundness of press design is found in deep drawing operations . . . particularly those where wall thickness dimensions must be maintained to close tolerances. Travel of the ram must take place with extreme accuracy. The slightest deflection most often means rejected work.

In deep drawing operations like these, Clearing Presses have always excelled. Unsolicited letters of recommendation from shops throughout the nation bear testimony to the "something extra" of Clearing Press design and construction. Illustrated here is one type of Clearing deep drawing press . . . a 300-ton Hydraulic Four-Point-Suspension Press.

In addition to providing accuracy, Clearing can also always give the advantage of operating speed and ease. You are invited to write for the facts about Clearing Presses. An outline of your work requirements will permit us to make recommendations specific to your needs.

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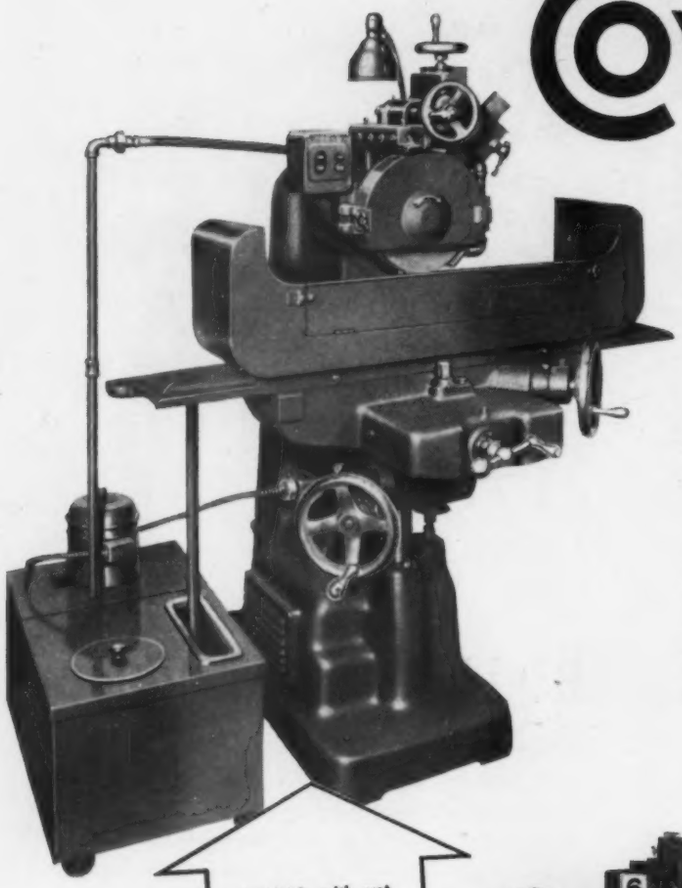
MECHANICAL AND HYDRAULIC PRESSES
FOR SUCH OPERATIONS AS DRAWING • BLANKING • FORMING • FORGING

COVEL No. 15

The SURFACE GRINDER for TOOL ROOM SAVINGS ...PRODUCTION PROFIT



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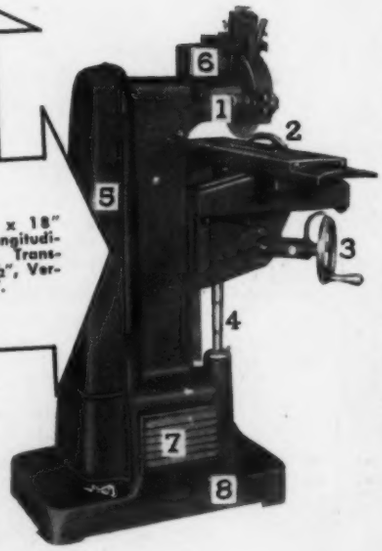
★ **Simple Controls**

★ **Easy job-to-job Change-over**

Available with wet or dry grinding attachments.

Hardened, precision-ground ways on knee for long life.

Table 6" x 18" Travel: Longitudinal—19½", Transverse — 7½", Vertical — 11".



1. Pre-loaded ball bearing spindle — completely dust protected.
2. Longitudinal hand feed unit — ball bearing and dust proof.
3. Elevating hand wheel with floating pointer — thousandth marks are ¼" apart.
4. Telescoping dust guards over column and elevating screw.
5. Hinged door in rear runs full length of column — for protection of and easy access to V-belt drive.
6. Push-button control — all wiring enclosed in column.
7. Motor, easily reached through rear door, is completely enclosed with ventilating louvres.
8. Extremely rigid, strong base and column cast in one piece.

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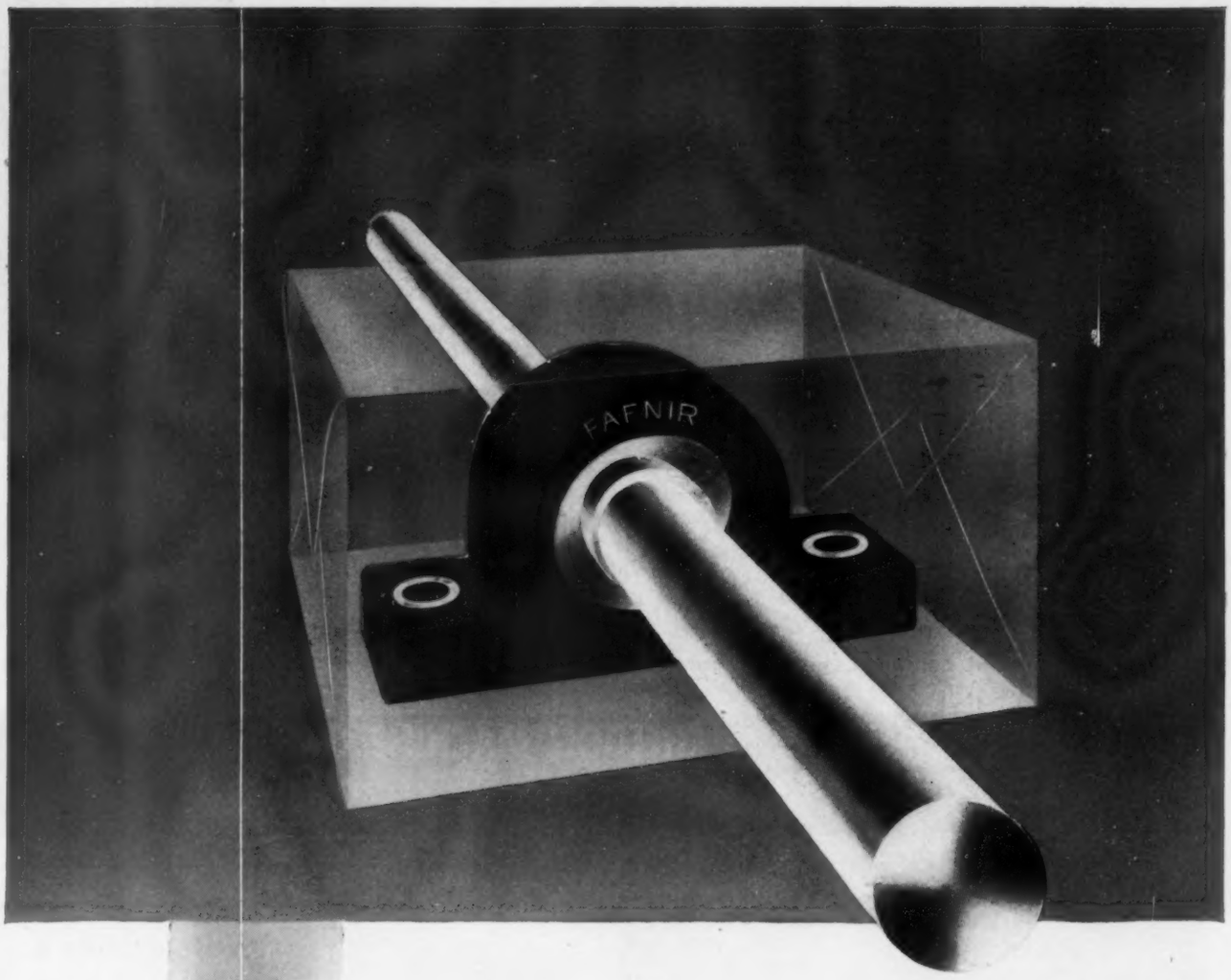
COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICHIGAN U. S. A.



a package of QUIET

Q-u-i-e-t! Just drop a pin and listen . . . That blower is running at 1700 r.p.m. Part of the noise you expected to hear just isn't there because the shaft is running on Fafnir Ball Bearings. And the rest of the racket . . . even blade vibration . . . is sponged up by the rubber housing into which these Fafnirs are pressed. That's Fafnir's "quiet kit", ready in a range of sizes for makers of household heaters, air conditioners and similar appliances.

Just one of the complete anti-friction packages that Fafnir makes for the movers of air. In addition to the rubber pillow blocks, there are all types of metal units both standard and knee type for service all the way from a small room fan to giant blowers for traffic tunnels.

And, if the job involves high temperatures, there's a floating type of Fafnir pillow block lubricated by oil which permits shaft expansion. For extremely high temperatures there's even a type with a water-cooling jacket. All these Fafnirs for blowers and fans employ the famous wide inner ring construction with the exclusive self-locking collar and seals for positively retaining lubricant and shutting out dirt.

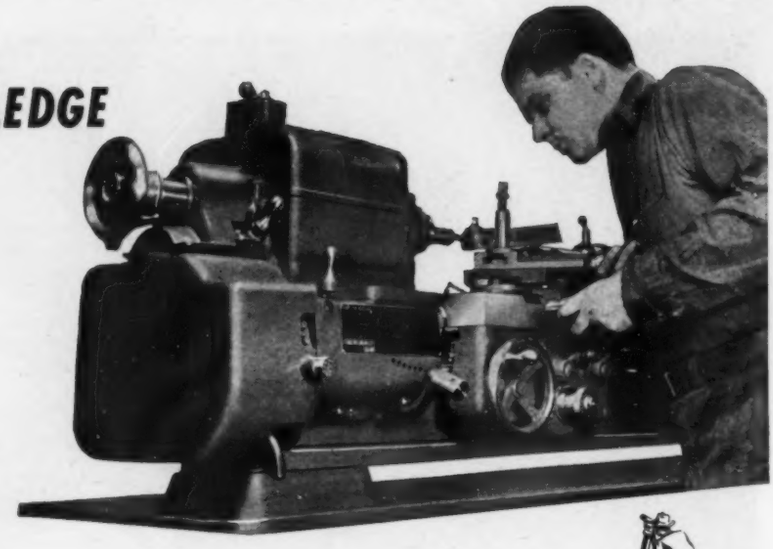
That's what Fafnir means by "most complete line in America" and what manufacturers mean when they say, "Let's put it up to Fafnir first".

The Fafnir Bearing Co., New Britain, Conn.

MOST COMPLETE LINE IN AMERICA

FAFNIR BALL BEARINGS

YOU DON'T USE A SLEDGE TO DRIVE TACKS.



There was a time when machine tools had to be heavy to be accurate but modern engineering and manufacturing methods have changed that. Today, the fully equipped shop has its big lathes for big work, and SHELDON S-56 Precision Lathes for small parts. With accuracy that will hold the closest tolerances and the stamina to stand up to continuous high speed operation, these smaller, handier, moderate priced lathes are cutting the cost of and increasing the hourly output of small turned parts.

From any angle, a better lathe.

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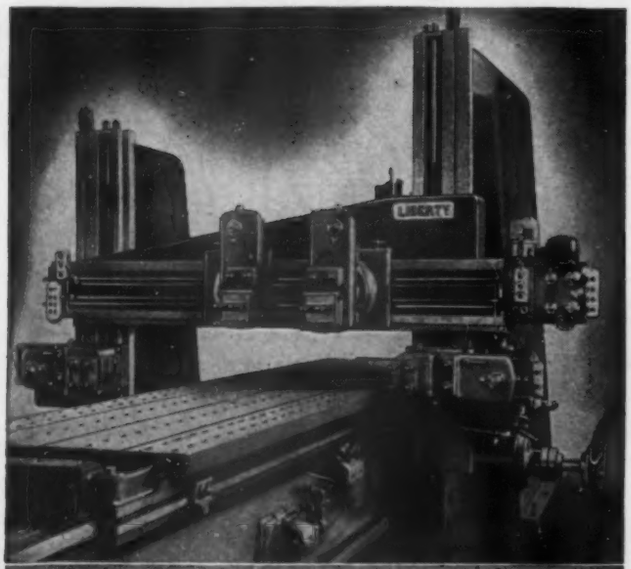
4234 N. Knox Ave., Chicago 41, U.S.A.



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FOR HIGH SPEED, LOW COST PRODUCTION

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Over a Quarter Century of Specialized Experience with Time Tested Principles of Design

Nothing like a
LINLEY
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New production will undoubtedly bring a variety of small jobs into busy tool rooms that must be done fast and accurately—to keep costs down. The Linley Milling and Jig Boring Machine has been built for just such work on jigs, dies, patterns, fixtures and models.

Table size (7" x 17½") is ample; 11½" provides plenty of room from table top to spindle end; only 2½ sq. ft. space needed. Linley features are 8 spindle speeds to 4250 R.P.M., velvet feed and no backlash in quill travel.

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Time was when the street vendor's musical cry, "Knives sharpened, fifteen cents!" represented the ultimate in off-hand tool grinding. Today, microtolerance machines coupled with tool room "know how" make tool sharpening a vitally important part of the production picture. The Lapointe Universal broach sharpening machine has long been recognized as the outstanding machine in its field. Wartime experience has proved this machine one of the best general tool sharpeners on the market. Here is a universal tool grinder, with precision slide-ways, and full 90° swivel head with indexing attachment to provide longer tool life.

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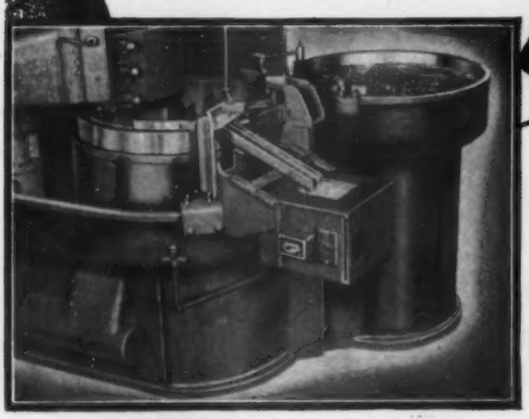


The HANCHETT 36-A

Automatic SURFACE GRINDER *For Fast, One-Pass Finishing of Smaller Parts . . .*

Here's the machine for you, if you're troubled with production grinding problems on small parts. For example, (left) a Hanchett 36-A grinds steel castellated nuts, 7/16" across flats. Power-driven rotary loading table feeds parts. Production — 75 pieces per minute, with .015" stock removal, both top and bottom. Parts automatically discharged from work table into chute through demagnetizer. Accuracy is assured because of the work sizer which checks each piece and automatically compensates for wheel wear. The 36-A is only one of the complete line of Hanchett Grinders. Consult Hanchett on any grinding problems. Since they make *all* types of surface, face and disc grinders, you can be sure of unbiased information.

See Your Nearest Hanchett Dealer, or Write for Bulletin 145-1AB.

HANCHETT GRINDERS — BIG RAPIDS, MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.

HANCHETT HERMETI-COIL MAGNETIC CHUCKS

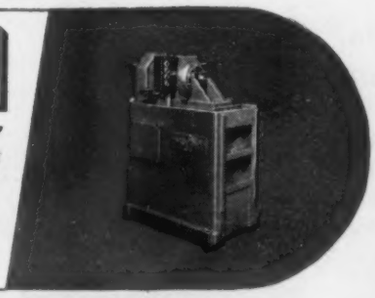
Now... YOUR CHOICE OF 3 PLAN-O-MILL MODELS

A PLAN-O-MILL FOR EVERY SIZE AND TYPE OF CYLINDRICAL FORM MILLING AND THREAD MILLING JOB . . . INTERNAL OR EXTERNAL

Save time, tools, materials and manpower with Plan-O-Mill. Whatever your form milling or thread milling job—internal or external—Plan-O-Mill does a precision job at a production rate.

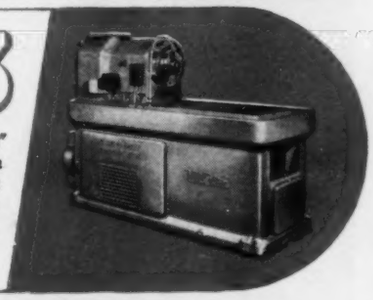
Choice of 3 Sizes

NUMBER 1



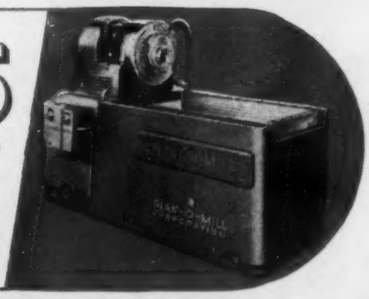
Threads and mills up to 2" I.D. or 2" O.D. (with offset head). Requires less than 9 square feet. Electronic feed and speed control panel may be mounted on floor, wall, or ceiling.

NUMBER 3



Threads and mills up to 8" I. D. or O. D. depending on amount of cut. Electronic feed and speed control with built-in control panel. Overall length: 75¼". Overall width: 37".

NUMBER 5



Threads and mills up to 20" I.D. or O.D. depending on amount of cut. Hydraulic feed and speed control. Overall length: 87". Overall width: 55¾".

CUTTING TOOLS

Years of on-the-job experience enable Plan-O-Mill engineers to design and make cutting tools of exceptional quality and performance. Precision inspected with the most modern gaging equipment. For more parts per grind, more grinds per tool, specify Plan-Co Cutting Tools.

FREE DATA SHEETS FOR PRODUCTION PLANNING

As an aid to industrial executives in planning new or expanded production, Plan-O-Mill offers a set of three production planning data sheets. Each sheet contains scale plan views of a Plan-O-Mill machine (which may be cut out and positioned on your factory floor plan), together with complete specifications. A set is yours upon request.

THREAD AND FORM PLAN-O-MILL MILLING MACHINES

PLAN-O-MILL CORPORATION

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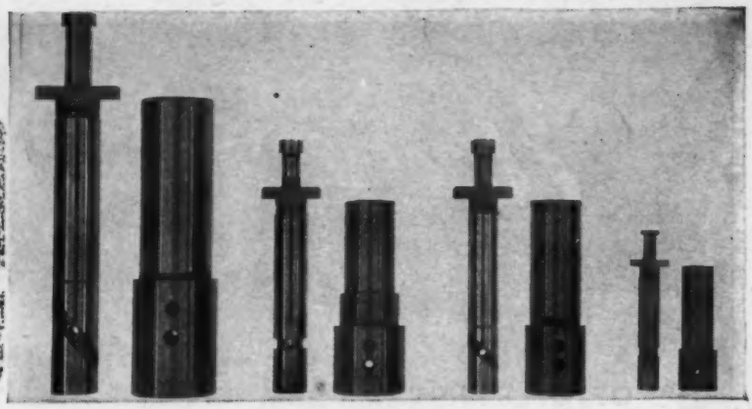
"Sunnen Precision Honing



Has Produced Fine Precision Work on Fuel Injection Pump Barrels"

. . . Scintilla Magneto Division, Bendix Aviation Corporation

For several years the Scintilla Magneto Division has had unusual success in producing extremely accurate work on the Sunnen Precision Honing Machine.

These machines have been very valuable and profitable, especially on jobs that cannot be handled on automatic machines. Sunnen honing is playing an important role in producing the accurate fit required on fuel pump barrels for diesel fuel injectors.

The accuracy of the Sunnen Precision Honing Machine is guaranteed to be within .0001" and has been held to within .000025" on production jobs in hardened steel. It can be used to size and finish holes from .185" to 2.625" in any metal or plastic except lead and babbitt. Can be quickly and easily set up — is easy to operate — does not require skilled labor — corrects out-of-round taper and rainbow conditions — maintains alignment between two holes — duplicates sizes easily.

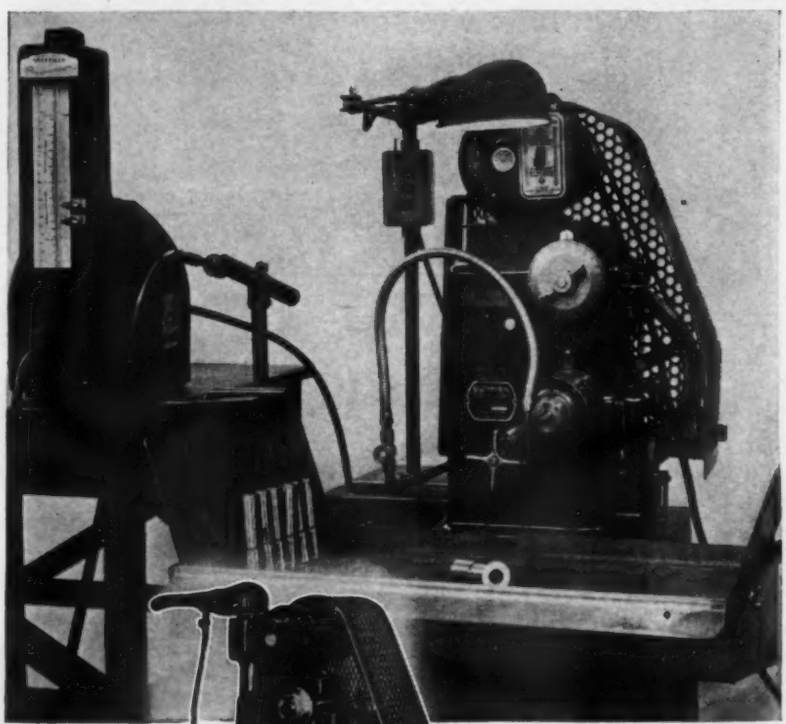
For complete details, write for descriptive literature — or ask a Sunnen engineer to show you how the many profitable advantages of Sunnen honing can be used in your plant.

SUNNEN PRODUCTS CO.

7941 Manchester Ave. • St. Louis 17, Mo.

Canadian Factory: Chatham, Ontario

SUNNEN



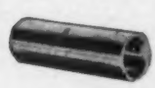
Typical Jobs

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping — and gave a straighter hole.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

Aircraft Carbureter Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.

Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.



Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.

GORTON

Tracer-Controlled MILLING

PROFILE MILLING SIMPLIFIED ...by TRACER CONTROL

Two Operations in a Single Setup without Changing Tools

• A prominent airplane engine manufacturer cut production costs, saved tying up expensive machinery and conserved skilled workmen by profile milling this radius of an engine crankshaft section on the Gorton Duplicator. Semi-skilled help operated this machine, obtaining smooth finish on the profiling of the irregular channel contour (1) on the part shown at right, and the milling of the channel (2) below this contour.

The Duplicator was set up with a special master in order to eliminate changing tools or resetting the work. A special fixture was used to hold the work at an angle to allow cutter access in milling the channel.

The Gorton Duplicator is the ideal machine for handling jobs like this where uniformity in quality and high precision repetition of all dimensions is required.

PRODUCTION DATA

Operations—Profile Mill .369" Radius and Mill Channel.
Machine—GORTON 9-J Super-Speed Duplicator.
Part—Rear of Crankshaft—Steel.
Cutter—Special .738" dia. Ball Cutter—4 Flute.
Holding Method—Special Fixture.
Feed—Manual.
Spindle Speed—500 r.p.m.
Stock Removed—1/8".
Floor-to-Floor Time—15 minutes per piece.

GORTON ENGINEERING SERVICE—

You are invited to consult Gorton engineers, without obligation, on your next production profile milling jobs. Gorton "Tracer Control" may give you the simplest, practical answer to lower cost production. Please submit part, print or specifications to your nearest Gorton Dealer or to the Gorton Factory at Racine, Wisconsin.

The Right Size... The Right Type... of Machine for Every Job...
From 2 oz. to 2 Ton
DIE BLOCKS

Tracer-Controlled MILLING

Tracer-Controlled DUPLICATING

Tracer-Controlled ENGRAVING

Tracer-Controlled ETCHING

GORTON ARMY E NAVY

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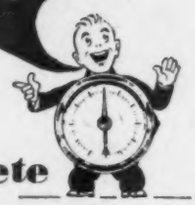
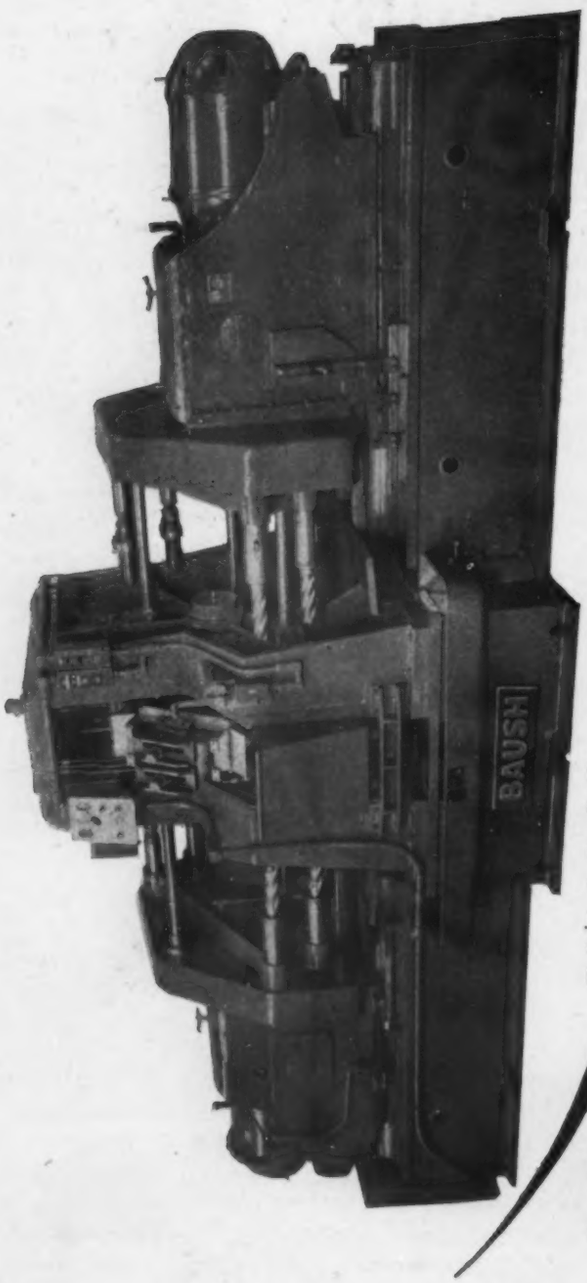


"Says Stop-Watch Pete of BAUSH"

". . . is to design multiple spindle units that complete several production steps in a single operation . . . ." This formula is exemplified by this Baush 2-Way Horizontal Hydraulic Multiple Spindle Machine of the unit type.

Designed for a large Diesel engine manufacturer, it combines 4 steps in wrist-pin production—chamfering, core drilling, line reaming and grooving—in a single machine.

Today's keen competition demands maximum production at minimum costs. BAUSH Machine Tools have answered this problem for leading manufacturers in nearly every field. They can do the same for YOU. A wire, phone call or letter will bring a BAUSH Engineer to help you solve your problems NOW.



Baush 2-Way Horizontal Hydraulic unit type of Multiple Spindle Machine has 6-station hand indexed trunion type fixture loading two parts at a station.

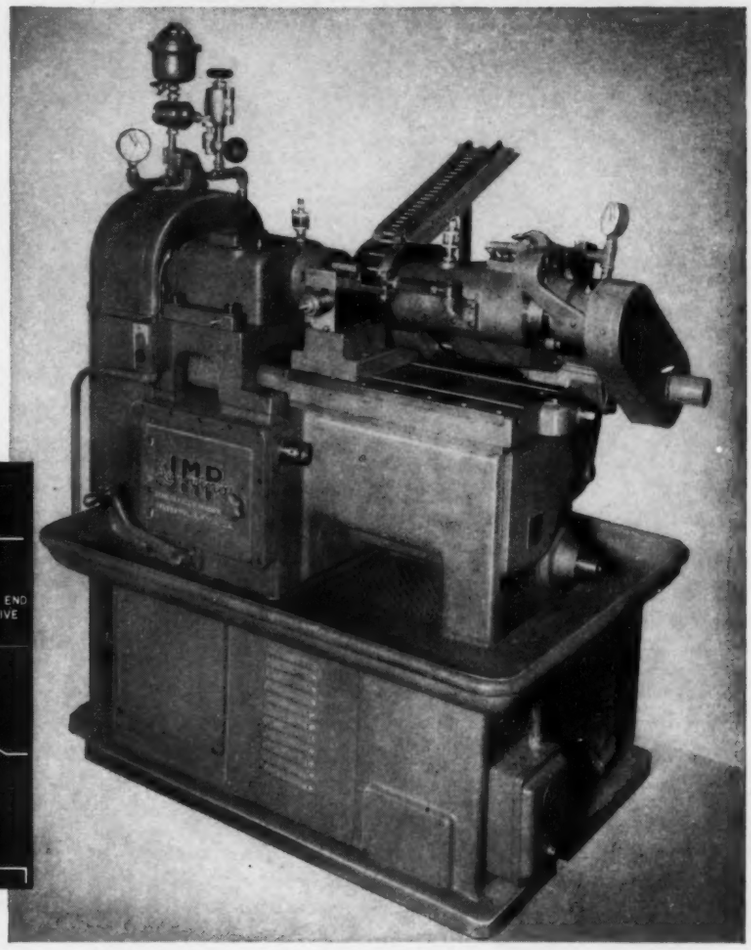
Designed to chamfer, core drill, line ream and groove heavy Diesel engine wrist pins in one operation—Left unit arranged for step drilling with 6 spindle fixed center head—Right unit arranged for 1 feed and dwell with 6 spindle fixed center head. Both have #30 hydraulic units, welded steel bases, hardened steel ways and large cooling trough.

MA[illegible] CO.
SPRIN[illegible] ETTS

BAUSH

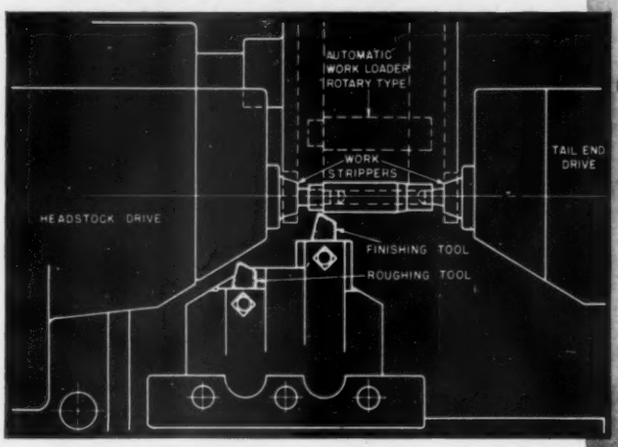
MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK



Lo-swing Imp Lathe equipped with Automatic Rotary Loader and Double-End Drive.

Tooling layout for turning Valve Guides on Lathe illustrated at right.



AUTOMATICALLY LOADED Lo-swing IMP SLASHES COSTS ON VALVE GUIDE JOB

PROBLEM: To rough and finish turn valve guides in one operation with separate tools.

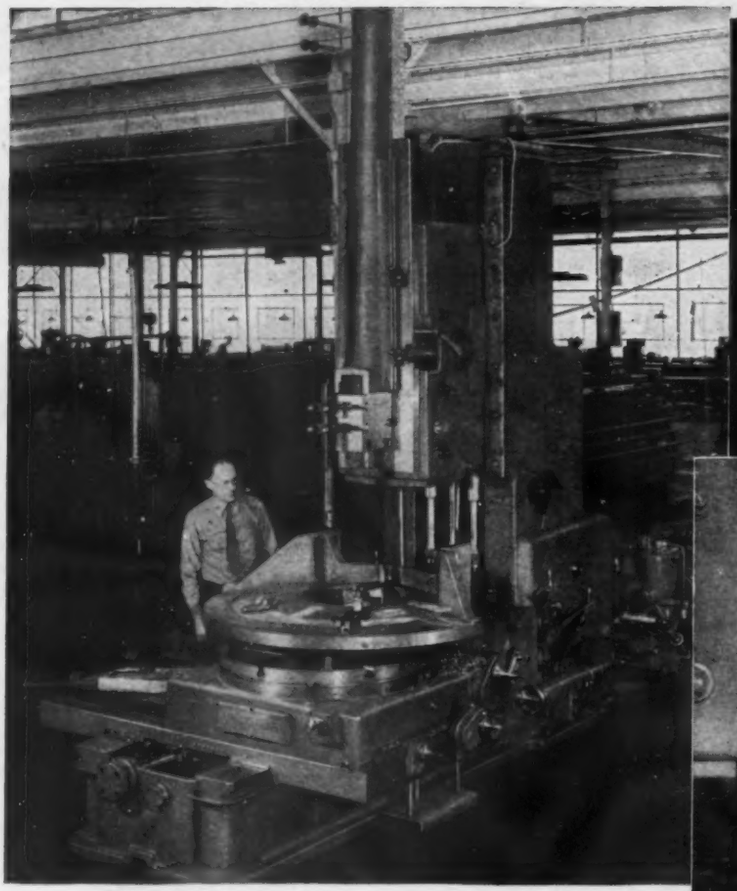
SOLUTION: The Lo-swing Imp Automatic Lathe was selected for this job and fitted with a new type Rotary loader and a complete new adaptation of tooling. This lathe is equipped with special revolving head and tailstock spindles driven from a splined jackshaft extending along the rear of the machine. The advantage of this double-end drive is two-fold; since the piece is driven from both ends much coarser carriage feeds are possible, thereby considerably increasing production; inasmuch as both spindles are driven, there is no wear on the revolving centers.

The machine is entirely automatic. Valve guides which have been previously bored to size are placed in a loading chute and fed by gravity into openings in the Rotary loader. The loader indexes the pieces to the proper position where they are automatically picked up by the continuously revolving spindles of both heads.

The O D is rough and finish turned in the same operation with two separate carbide tools, each having its individual feed. The finish turning tool begins cutting after the roughing tool has been relieved from the work, thereby assuring close concentricity between the bore and the finished diameter.

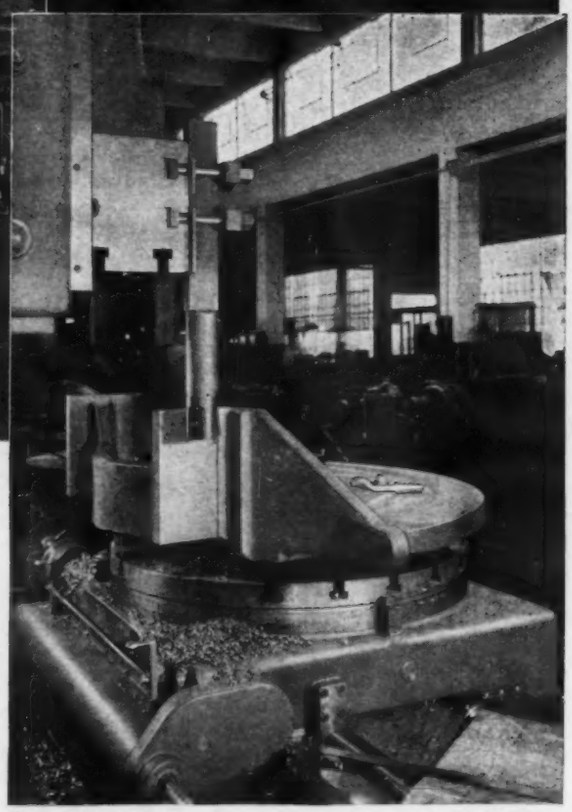
The Rotary type loader assures complete control over the fast revolving pieces eliminating danger to the operator and damage to the pieces which are completely stationary by the time they reach the discharge chute.

LATHE NEWS from SENECA FALLS



Another
ROCKFORD
Hy-Draulic
MACHINE TOOL

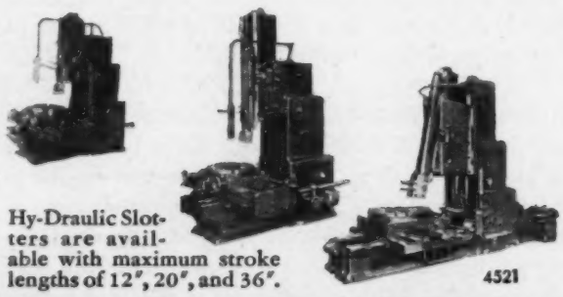
New machines with capacities and performance to meet present-day standards are essential to operating profits. Let us show you the advantages of modern Rockford Hy-Draulic Machine Tools.



ROCKFORD Hy-Draulic SLOTTERS
Are Made in Three Sizes.

Pays Its Own Way In A Hurry

Certain types of machining operations are "slotter jobs." Cumbersome or difficult for other machine tools, such work can be handled most easily and quickly on a Rockford Hy-Draulic Slotter. Extensive experience in a variety of shops has proved that Rockford Hy-Draulic Slotters are practical machine tools that pay for themselves in a hurry. Illustrated is a typical use; there are many, many others. Check your own machining operations for time-saving production-increasing slotter jobs. Meanwhile write today, for Hy-Draulic Slotter Bulletin 1132.



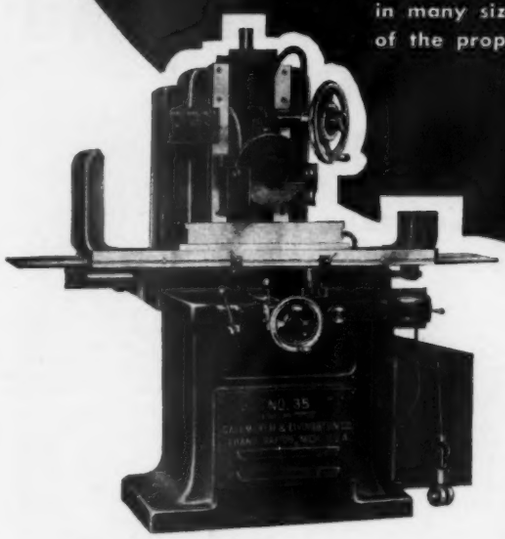
Hy-Draulic Slotters are available with maximum stroke lengths of 12", 20", and 36".

4521

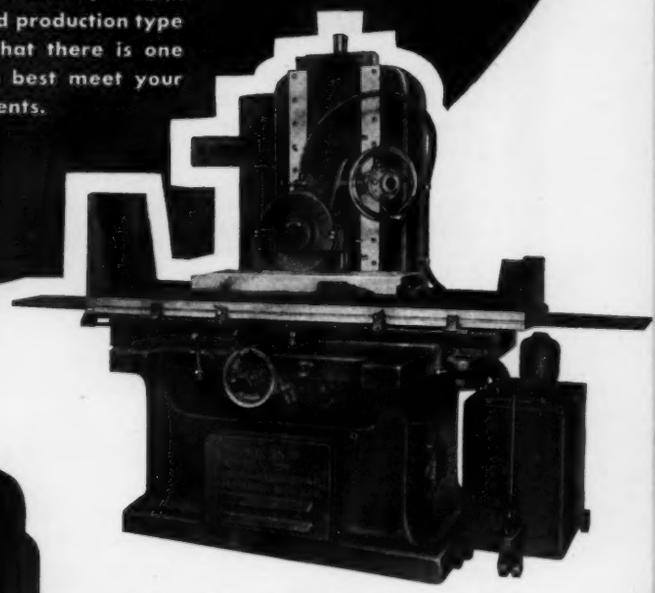
ROCKFORD MACHINE TOOL CO., ROCKFORD, ILLINOIS

GRAND RAPIDS
HYDRAULIC FEED SURFACE
Grinders

GALLMEYER & LIVINGSTON COMPANY is today building what is without question the finest, smoothest, and fastest Hydraulic Feed Surface Grinders of their entire career — a direct result of over 35 years of experience in the design and production of high grade precision grinding machinery. These machines are manufactured in both precision tool room type and production type in many sizes with the result that there is one of the proper size and type to best meet your particular requirements.



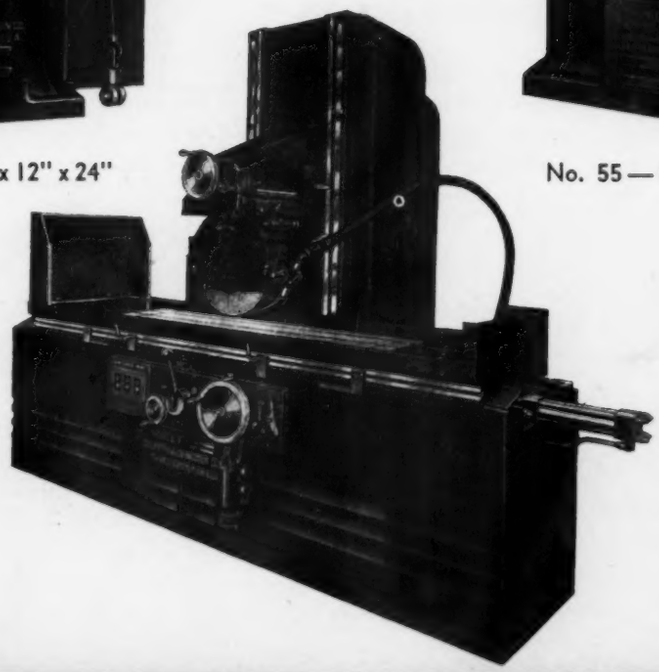
No. 35 — Capacity 8" x 12" x 24"



No. 55 — Capacity 12" x 17" x 36"

Precision Tool Room Type Machines

This is the type of GRAND RAPIDS Hydraulic Feed Surface Grinder on which one prominent machine tool builder obtains a 5 micro inch finish operating machine at 125 feet per minute. They are illustrated and described in bulletin GL-100.



Production Machines

GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders manufactured by the GALLMEYER & LIVINGSTON COMPANY are designated as Model F and Model A and feature the use of wide faced wheel and cross traveling head. GRAND RAPIDS Production Type Hydraulic Feed Surface Grinders are illustrated and described in bulletin GL-4-1-43. Write for your copy today.

GALLMEYER & LIVINGSTON CO.

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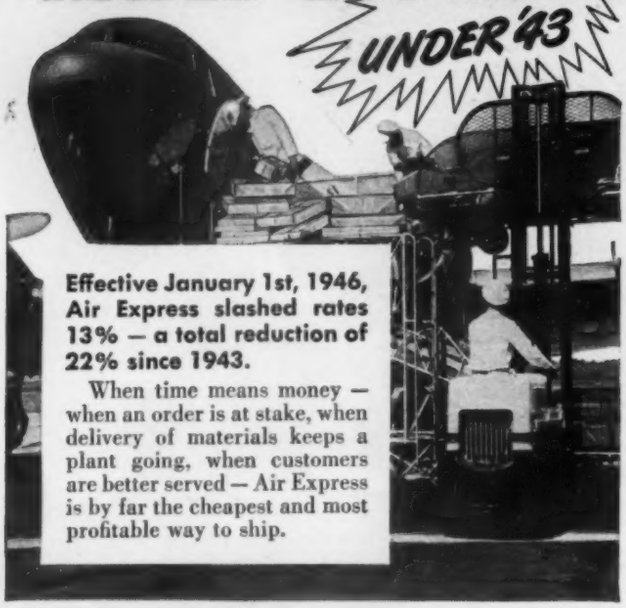

Effective January 1st, 1946, Air Express slashed rates 13% — a total reduction of 22% since 1943.

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Shipments travel at a speed of three miles a minute between principal U. S. towns and cities, with cost including special pick-up and delivery. Same-day delivery between many airport towns and cities. Rapid air-rail service to and from 23,000 off-airline points in the United States. Service direct by air to and from scores of foreign countries in planes made in America, operated by American personnel and flying the U. S. flag.

HERE'S HOW LITTLE IT COSTS (U. S. A.)

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349	1.02	1.18	2.30	3.68	9.21
549	1.07	1.42	3.04	6.14	15.35
1049	1.17	1.98	7.68	12.28	30.70
2349	1.48	3.53	17.65	28.24	70.61
Over 2350	1.47	3.68	18.43	29.47	73.68

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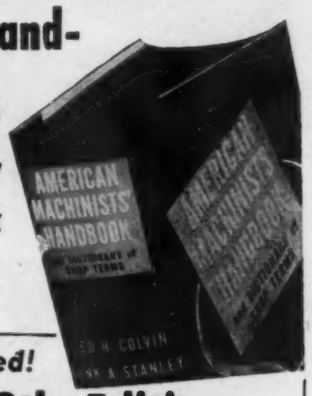
Answers hundreds of questions on machine-shop standards and practice — in everyday machine-shop work



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American Machinists' HANDBOOK

By FRED H. COLVIN

Editor Emeritus, *American Machinist*

and FRANK A. STANLEY

Editor, *Western Machinery and Steel World*

Just where can any worker find as much and so wide a variety of helpful material as is given in this well-planned and well-organized handbook? Just think of being able to find the answer— the "right" answer—to any question—"quickly"—layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances—a wealth of the most useful information applicable to problems that arise in every type of shop or plant, whatever its size, whatever its special problems.

28 helpful sections

Screw Threads
Pipe and Pipe Threads
Drilling
Reamers and Reaming
Taps and Tapping
Files and Work Benches
Babbitting, Brazing, Soldering and Welding
Gearing
Turning and Boring
Milling Machine Feeds and Speeds
Grinding, Honing and Lapping
Screw Machine Tools, Speeds
Punch Press Tools
Broaches and Broaching
Bolts, Nuts and Screws
Measuring and Fitting
Tapers and Dovetails
Shop and Drawing Room Standards
Wire Gauges and Stock Weights
Horse-power, Belts and Shafting
Metals and Other Materials
Machine Forgings
Knots and Slings
General Reference Tables
Automotive Data
Railroad Shop Data
Shop Trigonometry
Dictionary of Shop Terms

Don't wait till time of acute need to investigate this book, recognized everywhere as a standard manual of data, methods and definitions for apprentices, machinists, toolmakers, draftsmen, designers, foremen, superintendents, and all others who need dependable material in the machine-shop and metalworking field. Send for a copy today. Even a few accurate, up-to-date facts from this handy, "pocket-companion" volume will more than repay you its cost.

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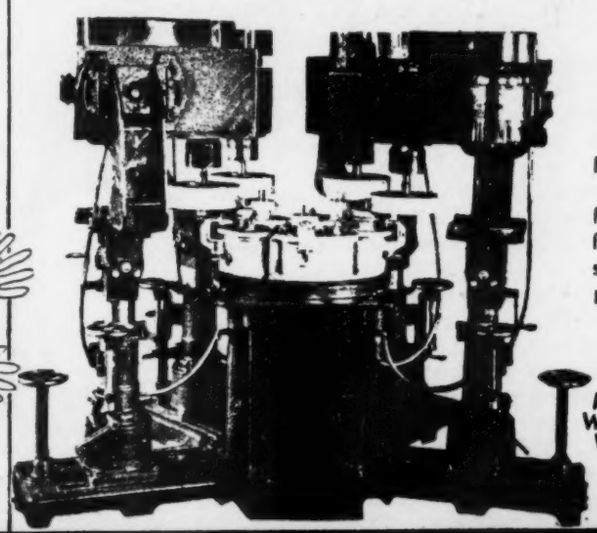


There's a Packer-Matic for all shapes, metals and finishes. Write for factory time study- send part and finish desired.

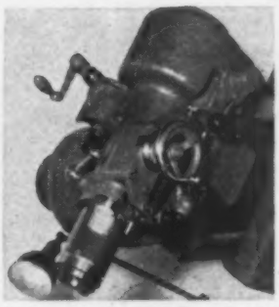
No. 4-S Indexing Type With Oscillating Wheel Heads

Packer-Matic

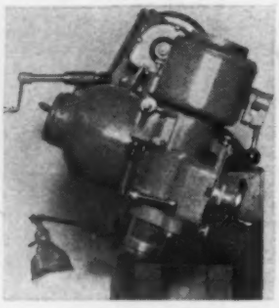
THE PACKER MACHINE CO., MERIDEN, CONN., U. S. A.

OUTSTANDING PERFORMANCE *from any* ANGLE!

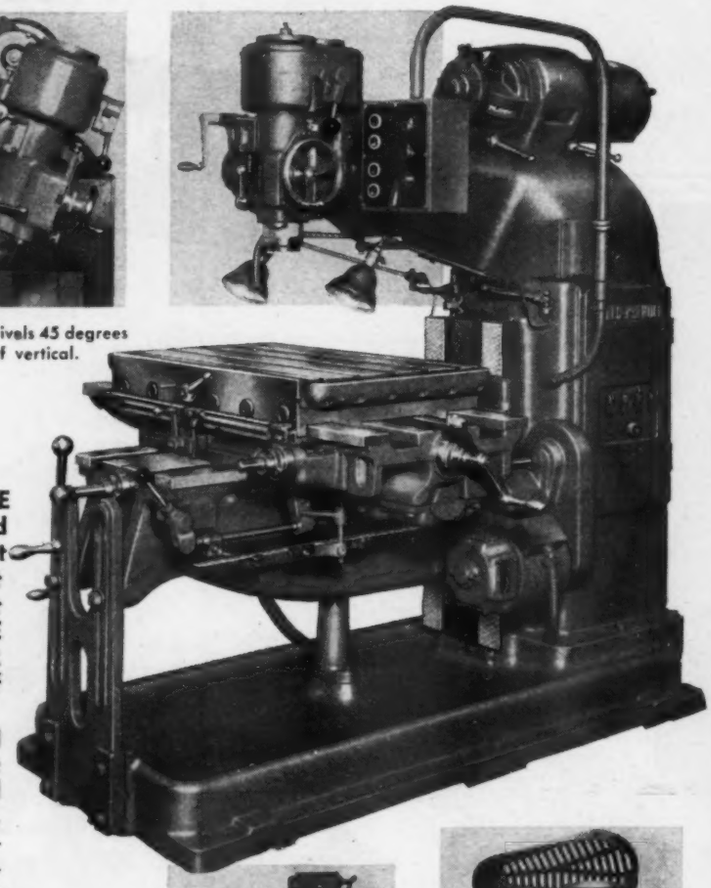
The 22-V VERTICAL MILLER and DIE SINKER



Universal head swivels 30 degrees left and right of vertical.



Universal head swivels 45 degrees front and back of vertical.

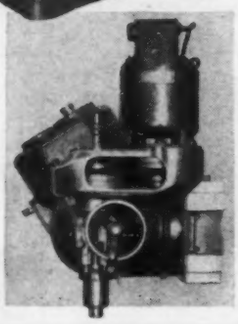


OUTSTANDING PERFORMANCE of the 22V Universal Head from any angle within 45 degrees front and back and within 30 degrees left and right of vertical—is a feature that has established this REED-PRENTICE VERTICAL MILLER and DIE SINKER as a versatile machine, capable of handling many jobs.

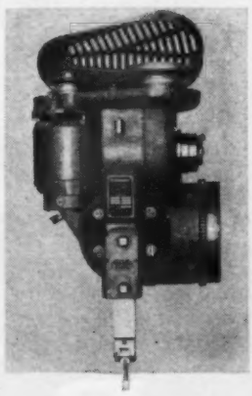
Wide range, large table and infinitely variable feeds and spindle speeds, permit milling, drilling and boring operations with one set-up. Electronically controlled cross and longitudinal power feeds (infinitely variable, ½" - 40" per min.) save production time!

The 22V Vertical Miller and Die Sinker efficiency is greatly increased by the use of attachments (see illustrations at right) which will give outstanding performance at any angle!

Ask for complete information on the 22V for the machining of plastic and rubber molds, die casting dies, forge dies or jigs and fixtures.



High speed milling attachment



Slotting attachment

MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS., U.S.A.

NEW YORK OFFICE:
75 West St., NewYork 6, N, Y.

CLEVELAND OFFICE:
1213 W. 3rd. St., Cleveland 13, Ohio

WHO BUYS AXELSON LATHES?

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U. S. ARMY
SHIPBUILDING YARDS
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TEXTILE INDUSTRY
PUMP INDUSTRY
RAILROADS
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OIL TOOL INDUSTRY
PAPER INDUSTRY
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MINING INDUSTRY
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NEWSPAPERS
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GOVERNMENTS
IRON WORKS
DIE COMPANIES
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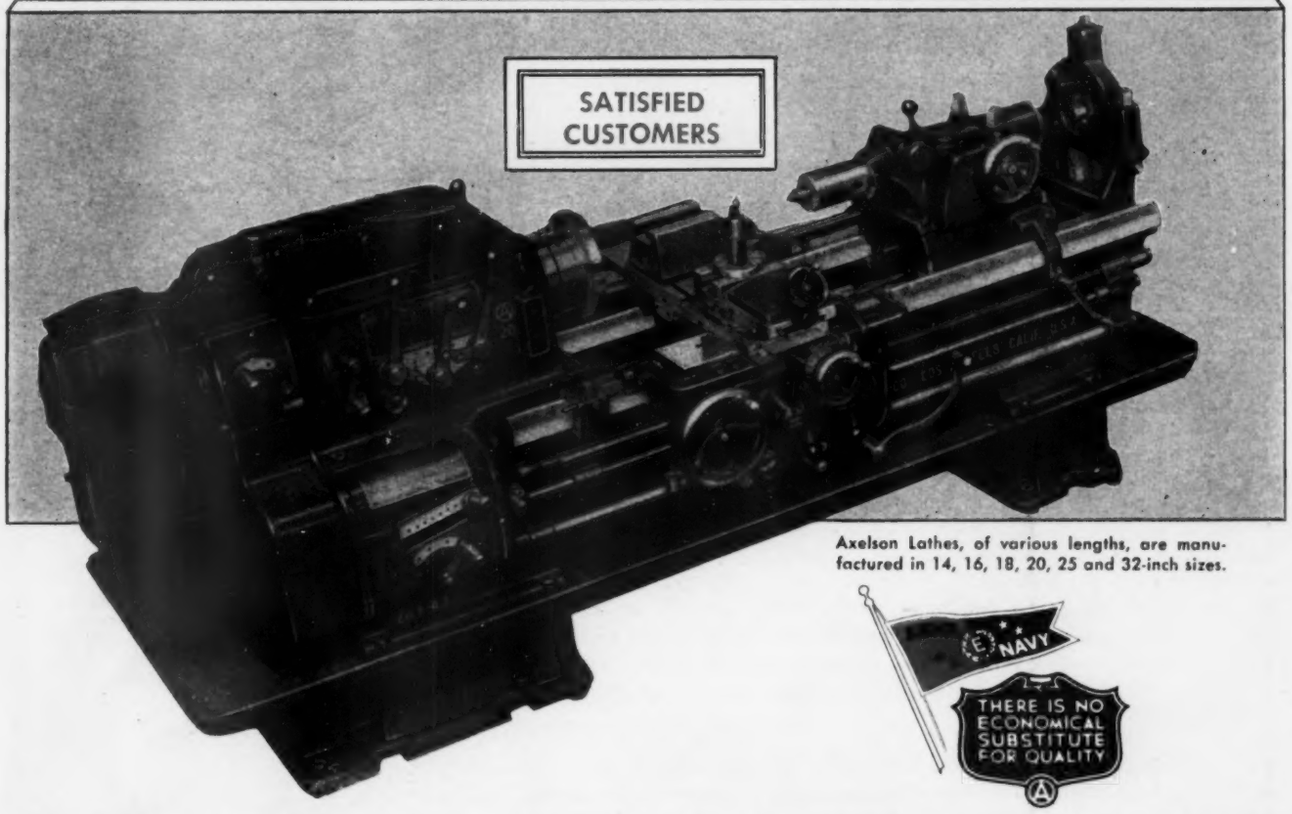
CONTRACTORS
AGRICULTURE
AIRCRAFT INDUSTRY
ALUMINUM INDUSTRY
AUTOMOBILE INDUSTRY

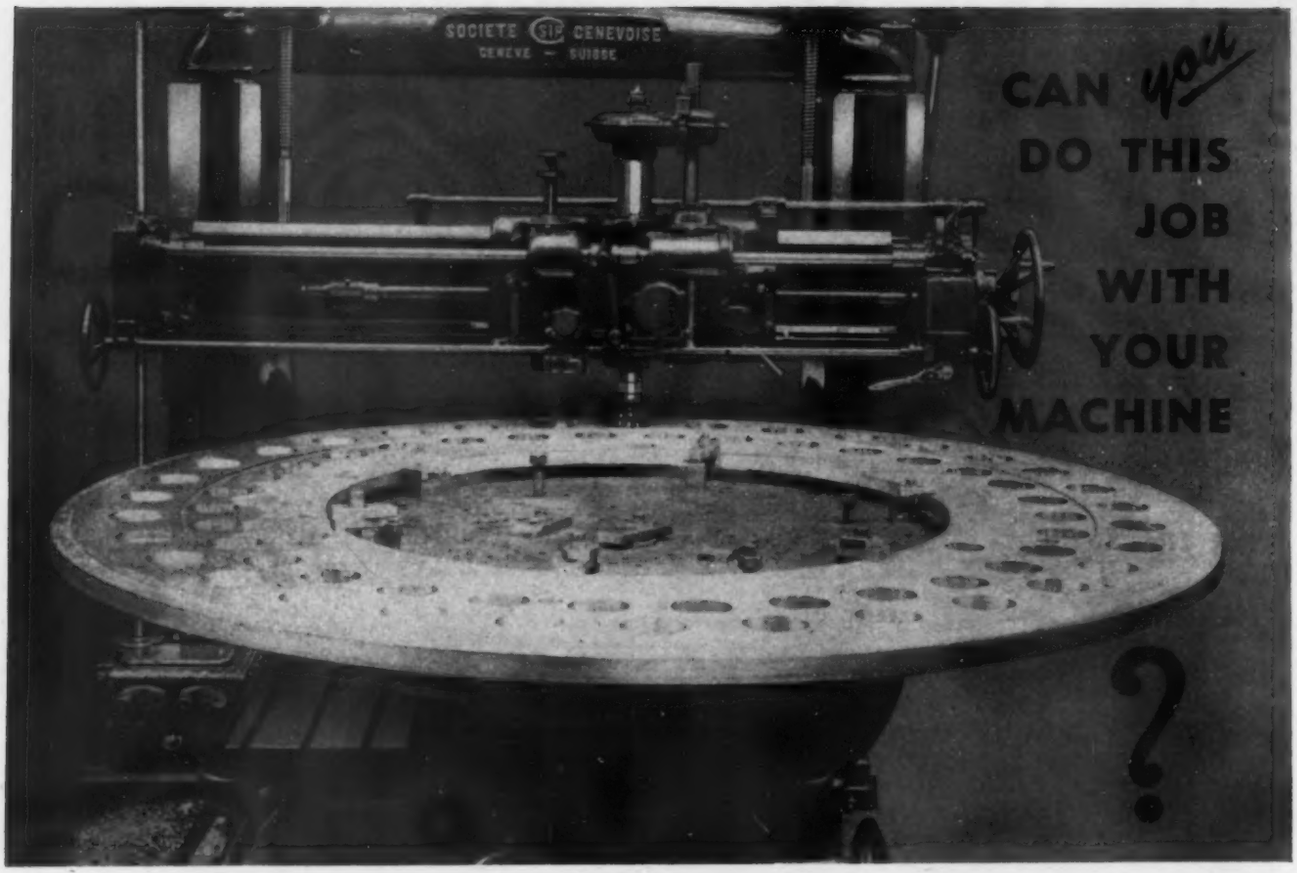


Axelson Lathes, of various lengths, are manufactured in 14, 16, 18, 20, 25 and 32-inch sizes.

Axelson Lathes are a blue-ribbon machine tool recognized and used by the major industries of the United States and by Governments and by leading metal turners all over the world . . . The list of Axelson customers puts on display a parade of great names in light and heavy industry everywhere. The reason for this is simple. The Axelson heavy duty Lathe is exceptional for it reflects thirty years of determination to achieve quality that will stand out in precision, performance and per-piece economy in operation. A great Lathe ready to serve superbly in the bright industrial future.

AXELSON MANUFACTURING CO.
6160 S. Boyle Ave. (Box 98, Vernon Station), Los Angeles 11, Calif.
50 Church St., New York City 7 • 3844 Walsh St., St. Louis, Mo.

AXELSON LATHES
Dependable for over a Quarter Century



IT'S { EASY AND ACCURATE AND FAST } ON A SIP JIG BORER!

Boring a gigantic circular plate to an exceptionally high degree of accuracy is easy and fast on a SIP Jig Borer . . . and practically impossible on a Jig Borer of conventional design! The double column design of SIP Jig Borers facilitates the handling of work of larger diameters than can ordinarily be accommodated. Large pieces such as that shown above can be extended into the space between the two uprights, instead of being limited by the depth of a throat as in a single-column machine.

Built in five sizes, SIP Borers are again available to American industry. World-famous for their ultra-precision performance, they are designed and built to retain their accuracy, even under the stresses imposed by large, heavy work.

If you need a Jig Borer that can perform to the most exacting limits of accuracy on large jobs or small, write for catalogs describing SIP Jig Borers in full. We can give excellent delivery on all five models listed below.

We also represent in the United States other world-famous Swiss High Precision Equipment: Andre Bechler—Maag Gear Whee l Co. — Mikron — Safag — Studer — Sallaz — Schaublin — Lienhard — Billeter.

RANGE OF TABLE SIZES

No. 2C	18" x 10¾"
No. 3K	21½" x 15"
No. 4G	27½" x 23⅝"
No. 5G (illustrated)	43⅜" x 32"
Hydroptic-B	39½" x 32"

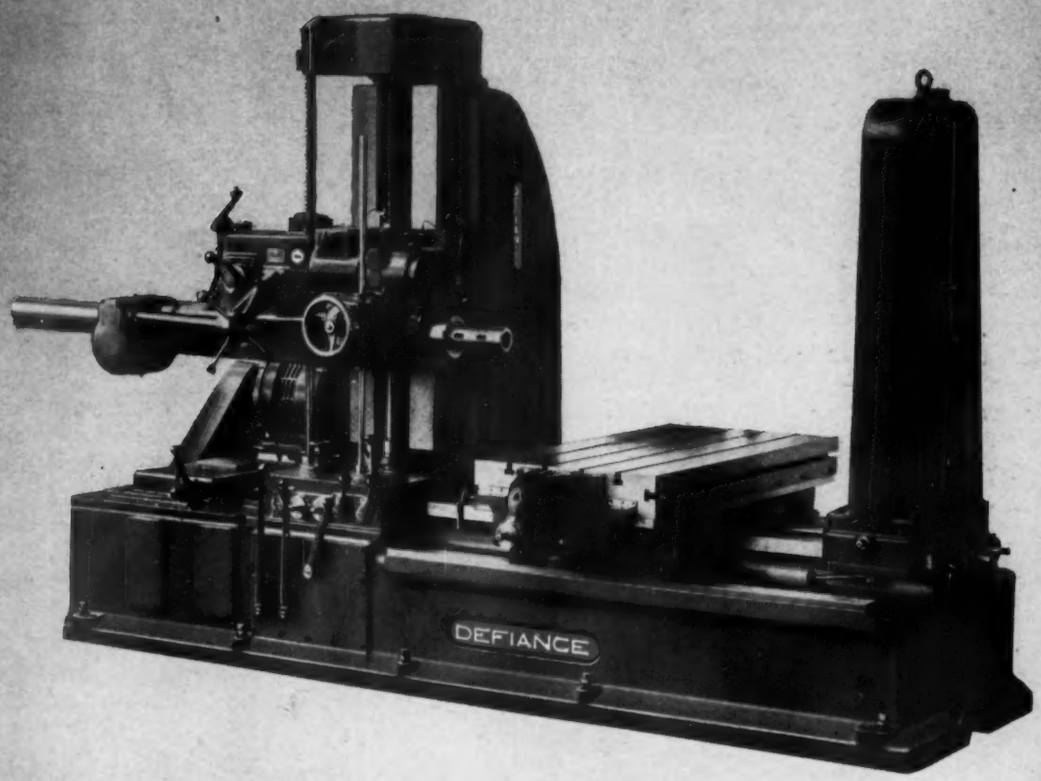
HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

DEFIANCE



DEFIANCE stands for Accuracy... appreciated today more than ever on America's "production front"... where Defiance Mills are helping plants beat tough production schedules with *speed* and *accuracy*.

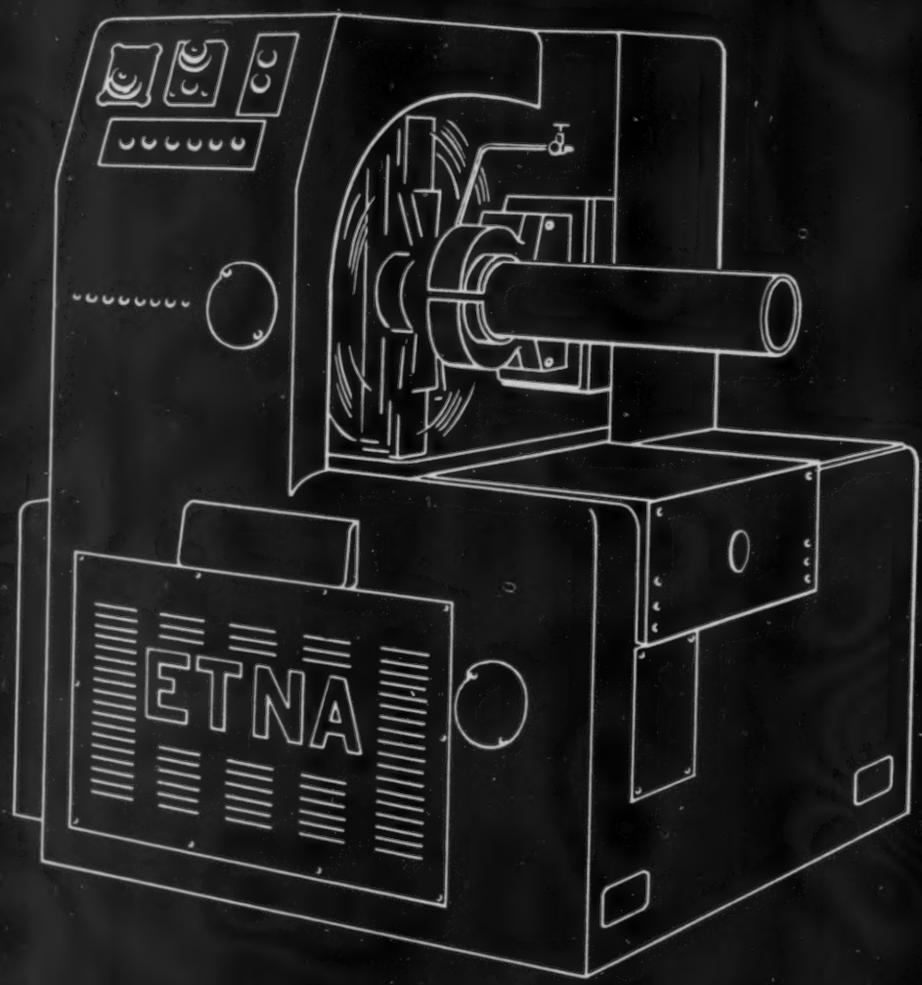
Defiance Machine Works, Inc., Defiance, Ohio

Makers of Precision Machinery Since 1850

ARMY NAVY

THE TUBE REMAINS STATIONARY...

IT'S THE CUTTER HEAD THAT ROTATES



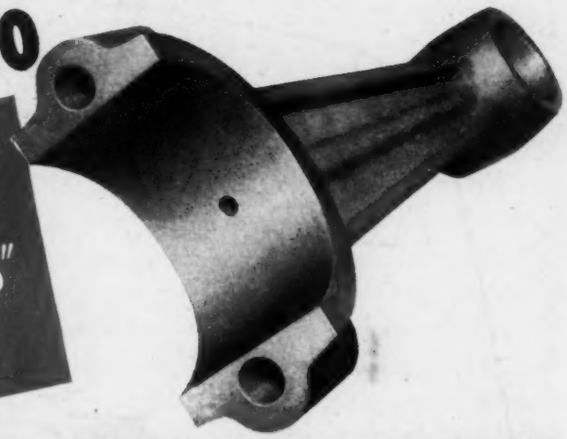
ETNA

Tube Cutoff Machine

THE ETNA MACHINE CO., TOLEDO 12, OHIO

30 Minutes TO

DRILL 7/8" OIL HOLE from SOLID through 45" LONG ROD



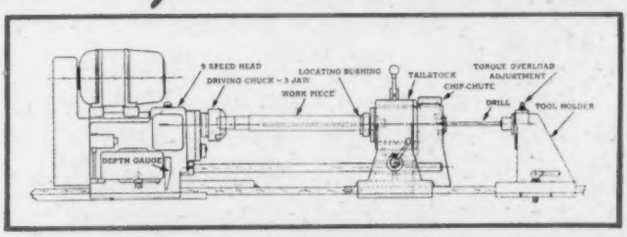
BARNES NO. 410 SINGLE SPINDLE DEEP HOLE DRILLING MACHINE PRODUCES ACCURATE, HIGHLY FINISHED BORES

Using single-lipped drills, this manufacturer *rifle drills* oil holes, ranging from 3/8" to 7/8" in diameter in diesel engine connecting rods, varying in length from 12" to 45", on a W. F. and John Barnes No. 410 Single Spindle Deep Hole Drilling Machine. When drilling the 7/8" diameter oil hole in a 45" long rod, the entire operation requires only 30 minutes, floor-to-floor time. The oil hole is drilled from solid, and an extremely fine, accurate finish is secured through the entire length of the connecting rod.

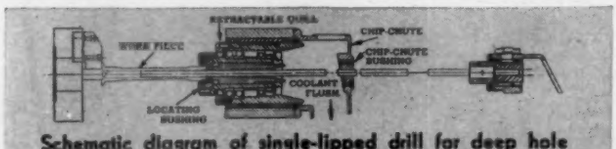
Deep Hole Drilling Performed Successfully and Economically at High Production Rates

The Barnes No. 410 Single Spindle Deep Hole Drilling Machine *drills straighter holes* with improved finish; and with low tool maintenance costs. Since the spindle and hydraulic pumps of this machine are driven by the same motor, constant feed per spindle revolution is assured, regardless of fluctuation in motor speed due to variance in loads. Excessive tool marks are prevented because of the positively controlled hydraulic actuation.

The superior finish obtained with single-lipped rifle drills will often eliminate rough reaming operations. Drills feed through the last fraction of cut instead of "breaking" through. Better production and lower tool costs are maintained through the torque overload for tool protection and the high pressure coolant system included in this machine.

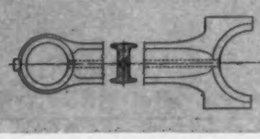


Schematic layout showing setup for deep hole drilling long shafts with single-lipped rifle drill.



Schematic diagram of single-lipped drill for deep hole drilling from solid.

Drawing of Diesel Engine Connecting Rod showing long oil hole drilled on W. F. and John Barnes Machine.



W. F. and John Barnes Company design and build Special Machine Tools for both low and high production requirements. Barnes engineers can assist you in adapting Barnes Deep Hole Drilling Machine — either single spindle, two-spindle or multi-spindle — to your specific deep hole drilling requirements. Send your blueprints and part specifications for recommendations. There is no obligation.

Here is Valuable Data

Barnes "SPECIAL MACHINE TOOLS" Book with interesting Performance Stories of Special Machine Tools on a wide variety of metal working jobs. It will be sent to all key executives without cost, when requested on company letterhead.

W. F. & JOHN BARNES

W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

. . . "Comfortable as an Old Shoe"

There's plenty of talk these days about functional machine design—design that, among other things, makes it easy and safe for the operator and maintenance man. We at Hendey are all for it, and have been for seventy years.

That's why it's easy to spot a Hendey Tool Room Lathe operator. He looks as if he's getting the work out, *and he is*, because a Hendey operator can concentrate on just that. He can get close to his machine and his work because there are no overhanging knobs and levers. He doesn't have to be a gymnast with a "boarding-house reach"; neither does he have to be a fancy dancer. He can stand in one spot and operate the few simplified controls with easy, natural motions.

This goes for the maintenance man too. Automatic lubrication is the rule, individual oil cups the exception. Occasional adjustments can be made easily and quickly without tying up the machine.

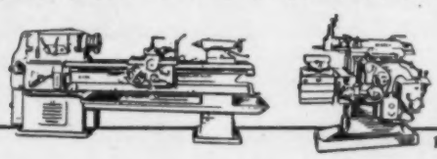
No wonder operators and maintenance men feel that a Hendey Tool Room Lathe is "Comfortable as an Old Shoe."

The Hendey Machine Company

Hendey

Main Office and Plant — Torrington, Connecticut

Branch Offices — New York, Chicago, Boston, Detroit, and Rochester
Representatives in — Phila., Cleveland, Los Angeles, Pittsburgh, San Francisco



TOOL ROOM LATHES
12"-16"-18"

SHAPERS
12"-16"-20"-24"-28"

Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT—A SPECIALTY.

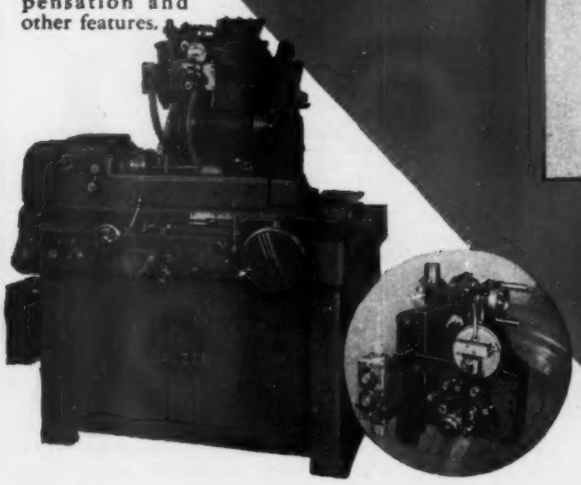
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life

Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.



Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.

DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.

MOREY *Universal* TURRET LATHES
for BAR or CHUCKING

THE TURRET LATHE *Your Operator* APPROVES!

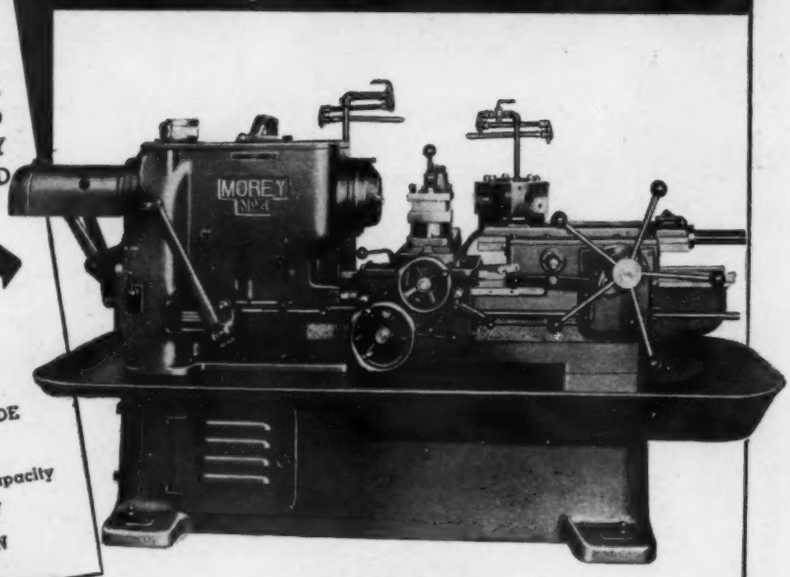
EASY TO OPERATE • ACCURATE
DEPENDABLE • RIGID AND
POWERFUL ENOUGH TO FULLY
UTILIZE PRESENT-DAY HIGHSPEED
CARBIDE TOOLS

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length 19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM.
constant speed motor, 1200 RPM
MAY BE HAD WITH PLAIN CROSS SLIDE

Also available in
No. 3 Universal, 1½" capacity
No. 2 Plain, 1" capacity

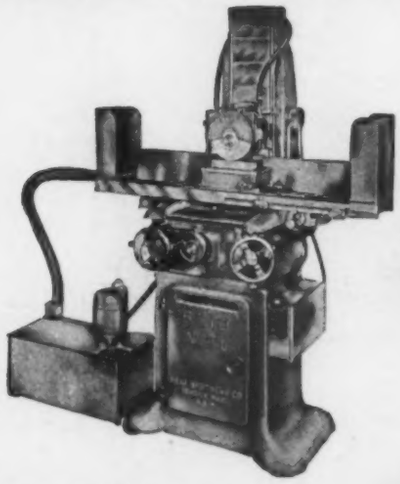
ASK FOR DESCRIPTIVE BULLETIN



STOCK DELIVERY

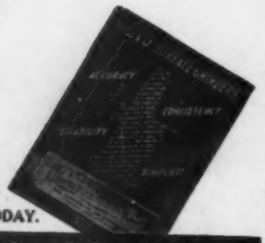
DESIGNED AND BUILT BY
MOREY MACHINERY CO., INC. 410 BROOME STREET, NEW YORK 13, N. Y.
PLANT: 4-57 26TH AVE., ASTORIA 2, NEW YORK

REID *Precision*
SURFACE GRINDER



EQUIPPED FOR WET GRINDING

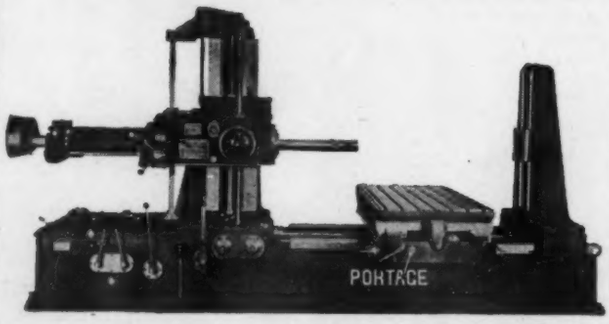
MAINTAINED ACCURACY WITH ECONOMY.



SEND FOR CATALOG AND PRICE LIST TODAY.

REID BROTHERS CO. INC.
BEVERLY MASSACHUSETTS

PORTAGE



NO. 4 HORIZONTAL BORING DRILLING & MILLING MACHINE

• A ruggedly built machine capable of operation at maximum speeds and feeds to produce accurately finished work. . . . Machine furnished with coolant type table with either 36" x 60" working surface and 48" cross travel, or 48" x 72" working surface and 60" cross travel. . . . Extra height columns increase working capacity. . . . For greater speed—precision—high production specify PORTAGE.

WRITE for full descriptive bulletin today.

THE PORTAGE MACHINE CO.
AKRON 11, OHIO

Super Smooth

FINISH FOR INTRICATE PLASTIC MOULDS

No. 8—A light weight tool, but precision built throughout. Speed: 18,000 r.p.m. Weight: 2 lbs., 6 oz. 1/20 h.p.

High Speed, Perfectly Balanced Dumore Hand Grinders Assure Extreme Accuracy on Finishing Operations

To give thermo plastic products their highly polished surfaces, the moulds in which they are made must be super smooth. First, machine marks and surplus metal must be removed from the intricate steel moulds, and then the required size and surface finish provided by highly skillful hand grinding and polishing.

On these operations, The Chicago Molded Products Co., which produces thousands of plastic products weekly, has used Dumore No. 8 Hand Grinders with great success. For the light weight and perfect balance of these Dumores, their high speed and smooth power, enable the operator to remove material with extreme accuracy . . . to maneuver a variety of tiny mounted wheels and brushes in close quarters with surprising ease.

In countless other ways Dumore Hand Grinders are demonstrating daily their ability to take the short-cut ways to greater production. Find out how they can help *you*—write for Dumore's new grinding handbook, "Here's How." The Dumore Company, Tool Division, Dept. TB14, Racine, Wisconsin. (Eastern Sales and Service Branch, 13 East 40th Street, New York 16, N. Y.)

No. 10—A tool with *double* the power of the average grinder. Speed: 22,000 r.p.m. Weight: 2 lbs., 15 oz. 1/10 h.p.

No. 9—Powerful, smooth handling, yet gets into tight quarters easily. Speed: 15,500 r. p. m. Weight: 7½ lbs. ¼ h. p.

DUMORE

PRECISION AND HAND GRINDERS

Sold by Authorized Industrial Distributors in All Principal Cities

NESTED MATERIAL IS SECURELY HELD UNDER HEAVY CUTS ON THE

PORTER-McLEOD COLD METAL SAWING MACHINE

Ability to cut stock from 3 inches up, to nest and hold bars or shapes securely for multiple cutting, combined with a standard feed of 3" per minute enable this modern, sturdy, clean-lined machine to make big savings in cutting-off time. A wide range of work can be handled by the 8" Porter-McLeod because of its capacity for 8" round or 7½" square stock. All cuts are accurately and cleanly made at highest speeds.

Truly high production is assured by unique features of design coupled with ample power. The blade is pulled upward through the stock, the blade being supported in such a way as to prevent buckling or weaving. Protection of the blade against hard spots in the stock being cut is provided by a friction disc feed. The Porter-McLeod blades are designed so that every tooth cuts, a feature which contributes to the remarkably fast cutting assured by this machine.

If you are interested in reducing time on cutting-off operations, get all details at once. Anyway, write for Descriptive Bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U.S.A.

MACHINE TOOL COMPANY

TIME-SAVING MACHINE TOOLS SINCE 1901

Moline Tool Company since 1901 has been designing and building machine tools of the highest degree of efficiency for these operations:

- Boring—rough, semi-finish and finish
- Honing
- Milling—(special machines)
- Straight Line Drillers
- Universal adjustable spindle drillers
- Way Type Machines—horizontal and vertical drilling, tapping and boring machines

"Hole Hog" machine tools are versatile—their construction makes possible easy change-over to other jobs. They are easy to operate and are ruggedly built for years of continuous production service. For man-hour savings—for more efficient, smoother work—look to Moline machines.

Write for information concerning machine tool equipment for your special problems.

MOLINE TOOL CO. HOLE HOG MOLINE, ILLINOIS

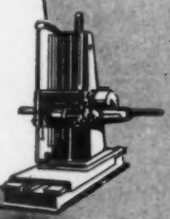
MOLINE TOOL COMPANY
20th Street MOLINE, ILLINOIS

Consider
LELAND GIFFORD
NO. 1 MOTOR SPINDLE DRILLING MACHINES
For Drilling Holes No. 80 to 5 16" diameter. Rigid, Accurate, Easy to Operate, Long Lived, Very Sensitive.
Send for Bulletin No. 400A

LELAND GIFFORD
WORCESTER 1, MASSACHUSETTS, U. S. A.

GILBERT

PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

"The Best Lathe Ever Made!"

ST. LOUIS
AUSTRALIA
MELBOURNE
Says User from "Down Under," about his 22" HYDRATROL LATHE
LEHMANN MACHINE COMPANY ST. LOUIS U.S.A.
LEHMANN MACHINE COMPANY ST. LOUIS U.S.A.

Heavy Duty Lathes
20" to 36"

THIS Melbourne concern, which has had a 22" Heavy Duty HYDRATROL LATHE in constant use for the past 2 years, recently wrote us:

"We have had lathes from all nations in use these twenty-five years, but your lathe is certainly something to be proud about.

"We have found that the design is really marvelous, and has been carried out to perfection.

"I, and all my business friends that have seen this Hydratrol Lathe working, agree that it is the best engine lathe ever manufactured, and you have every reason to be proud of your product."

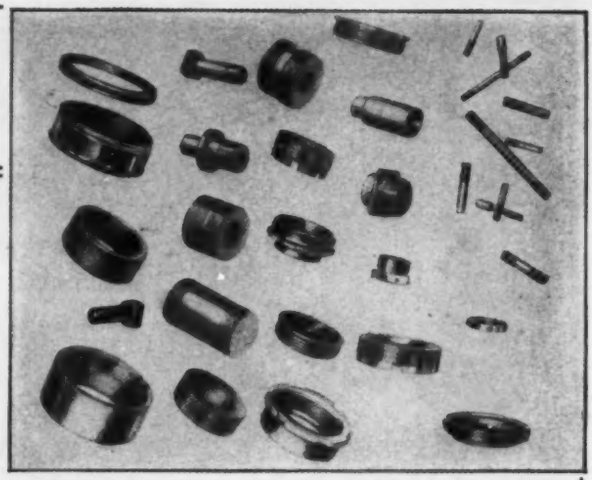
Let us show you what a Heavy Duty HYDRATROL LATHE could do in *your* shop.

LEHMANN MACHINE COMPANY, ST. LOUIS 3, MISSOURI

HYDRATROL LATHES

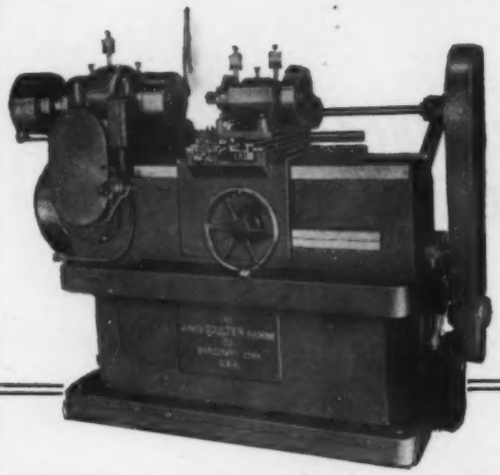
(HEAVY DUTY TYPES)

. . . for Precision Internal or External Threads . . . Right or Left Hand



HANDLE PRODUCTION AUTOMATICALLY on the

COULTER HOB THREAD MILLER



This modern machine can be depended on to produce and duplicate close tolerance threaded parts. With the exception of loading, all operations are fully automatic. Any parts that can be held in a Universal chuck, air-operated chuck or special fixture can be threaded, on the COULTER, internally or externally, either right or left hand.

Work can be inserted from either face or rear end, through large hole in work spindle, thereby making possible the threading of shaft ends, tubing or other long work.

Individual Motors on the COULTER for work and cutter spindles provide a wide range of speeds and feeds for handling such materials as brass, aluminum or steel.

Illustrated literature covering full details of this machine is available promptly on request.

THE JAMES COULTER MACHINE CO.

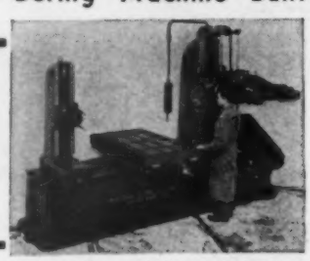
BRIDGEPORT, CONNECTICUT

UNIVERSAL *Horizontal Boring Machine*

The only TRIWAY *Boring Machine Built*

Made in 3", 4" and 5" spindle sizes.

Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.

Hudson, Mass., U. S. A.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL

913 Tilden St.

Saginaw, Michigan

S&M

SMITH & MILLS

CRANK SHAPERS

Sizes 12" to 32" Stroke

THE SMITH & MILLS CO. Cincinnati 25, Ohio

CARLTON RADIAL DRILL

"Anti-friction Bearings Throughout"

FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**

MACHINE TOOL COMPANY

CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

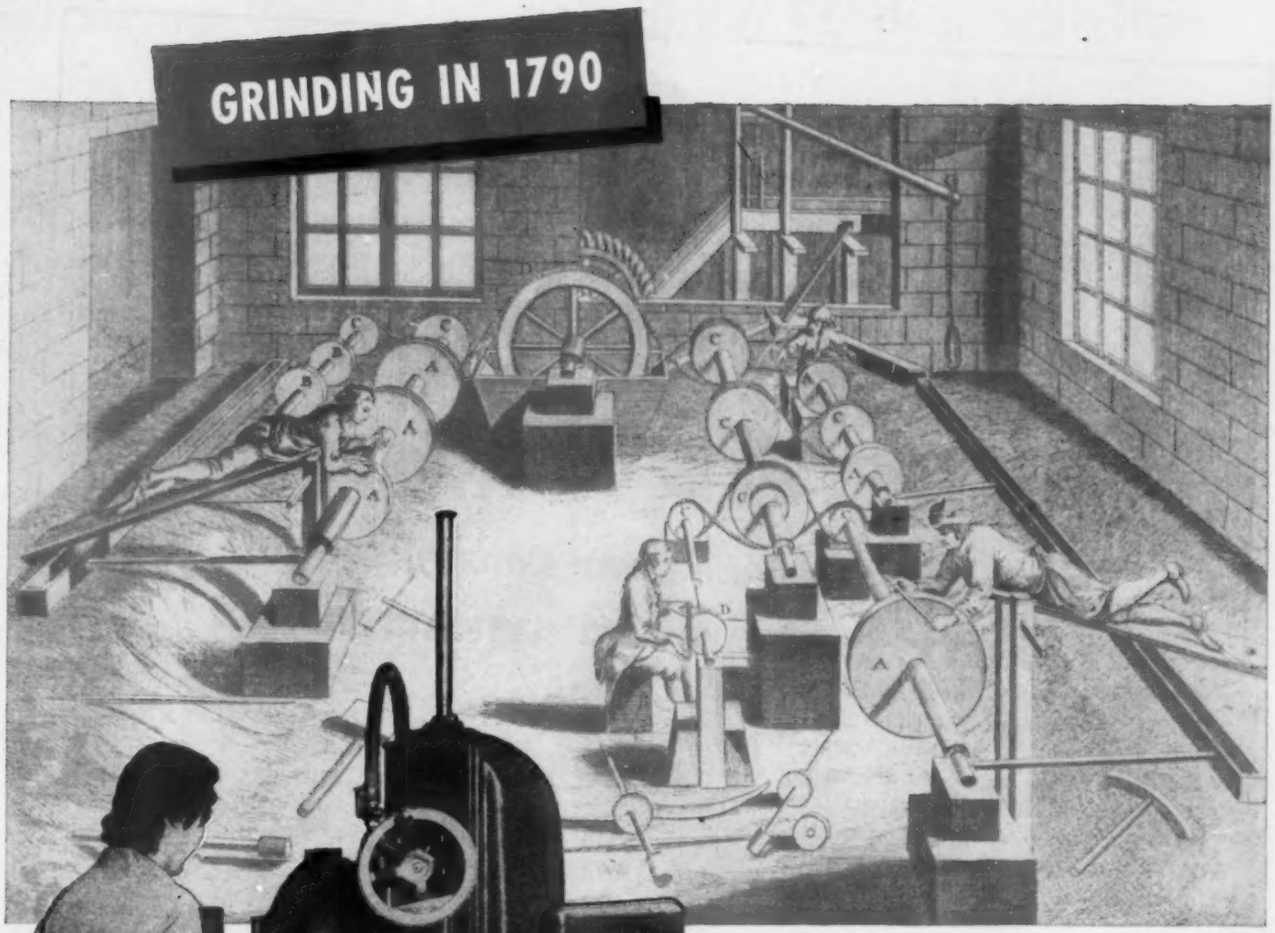
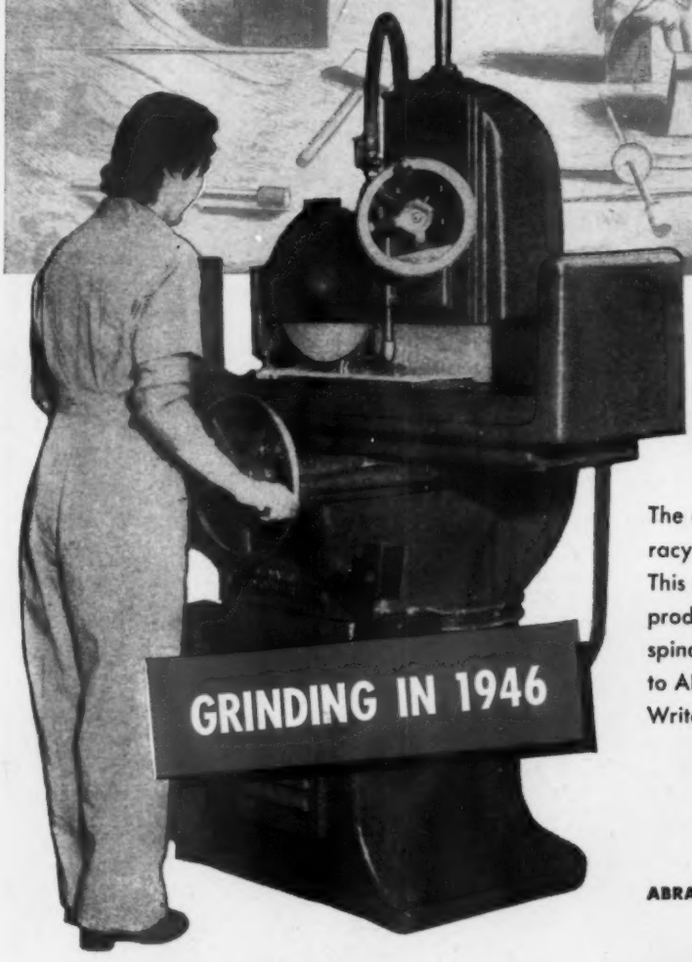


Illustration from Bettman Archives



ABRASIVE No. 1½

The eighteenth century workman never dreamed of the accuracy and ease of operation built into the ABRASIVE No. 1½. This hand operated machine combines precision with speedy production . . . it has simple, convenient controls and a unique spindle design with built-in motor. The No. 1½ is engineered to ABRASIVE'S high standards and is built for lifetime service. Write for Bulletin.

ABRASIVE Machines on the Government Machine Tool Surplus Lists may be the answer to your immediate problem of replacing obsolete machinery. Send us the machine serial number for any desired information; we will endeavor to provide attachments, accessories and repair parts as required.

ABRASIVE MACHINE TOOL CO. **East Providence 14, R. I.**

ABRASIVE No. 1½ HAND FEED SURFACE GRINDER
Work capacity: 15" long x 10" wide x 12" high.
Table size overall: 48" x 11¼".
Net weight: 1,350 lbs.

Attachments for wet and dry grinding are available.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

AO Ful-Vue
ACETATE GOGGLES

Expertly Designed and Constructed for

SAFETY, COMFORT AND ATTRACTIVENESS

AO Ful-vue Acetate Goggles are lightweight for comfort during long use — yet are strong and durable. They offer all-round protection against impact from flying particles — are also available with absorptive lenses for protection against glare and injurious light rays. Particularly suited for the worker whose skin is sensitive to metal. Made in three eye sizes and three bridge sizes — with 6 Curve Super Armorplate, Clear or Calobar lenses — with or without side shields. May also be fitted with inexpensive AO Fits-On Goggles (shown in cut) to prevent pitting and scratching of the valuable lenses. Your nearest AO Safety Representative can supply you.

American Optical
COMPANY
SOUTHBRIDGE, MASSACHUSETTS
Safety Division

Get Better Visibility . . . and Better Work . . . with these

New Transparent Cutting Oils!

FROM SHOPS all over the country, facts and figures are coming in, attesting the superior performance of Socony-Vacuum's new light-colored transparent, odorless Sultran Oils.

Pictured here is a typical example, the hobbing of stainless steel (18-8) gears for precision instruments. The gears are held to tolerances of ±.0005 of an inch.

On this precision work, the shop superintendent reports far better visibility of the work in progress, an important advantage in starting the cut. He says that he is getting marked improvements in the finish, and a 20% reduction in hob wear. His operators like the new oils because there's no odor to cling to their clothing.

The same advantages are reported for virtually all other types of cutting operations. For these new oils not only assure better visibility and absence of odor, but also possess high lubricity and exceptional anti-weld properties. Try them now for smoother, more efficient production and more pleasant working conditions for your operators.

TUNE IN "INFORMATION PLEASE"
MONDAY EVENINGS, 9:30 E.S.T.—NBC

Get this Complete Lubrication Program for all your machines

- Lubrication Study of Your Entire Plant
- Recommendations to Improve Lubrication
- Lubrication Schedules and Controls
- Skilled Engineering Counsel
- Progress Reports of Benefits Obtained

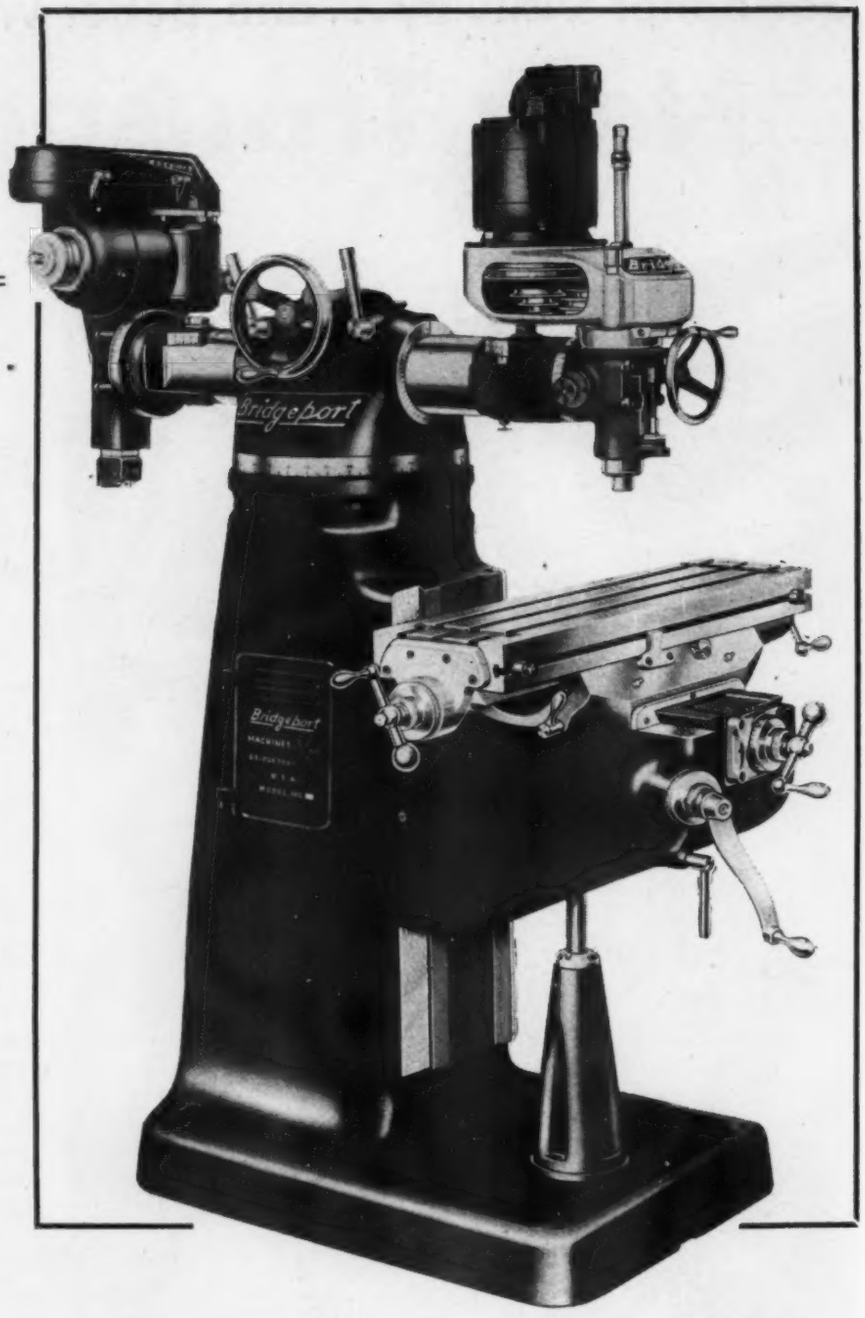
GARGOYLE Lubricants

Socony-Vacuum Oil Co., Inc.

and Affiliates: Magnolia Petroleum Co. · General Petroleum Corp. of Calif.

Bridgeport

TURRET MILLING MACHINE



SPECIFICATIONS

Longitudinal Feed	20"
Cross Feed	9"
Vertical Feed of Knee	16"
Standard Table	9" x 32"
Special Tables up to 48" available; also longitudinal power feed	
Weight with Shaping Unit—2000 lbs.	

This time- and effort-saving machine is destined to replace more and more old and obsolete equipment because it has proved its ability to handle more work at lower cost, with less operator effort and maintain close tolerances at peak production. Its versatility assures a maximum in machine hours, because it can mill, drill, bore and shape at all angles of the work with no time out for changing set-up. It is the machine of the future available NOW.

Write at once for complete details.

THE Bridgeport MACHINES, INC. BRIDGEPORT, CONN.

Where do YOU want to go FROM HERE?

● This is the Oster "RAPIDUCTION" *Standard* turning machine No. 601 as it looks before it is adapted to specific needs. This basic machine can be furnished with Worm Drive or Direct Drive and with 4-speed motor or 2-speed motor. Automatic chuck capacity is 1½" (round bar stock).

You Can Start with this *STANDARD* Chassis

Not a single "unwanted" part is on the basic No. 601 machine. From here, our engineers can readily adapt this machine to your EXACT needs. This makes it possible to quickly develop a "special" machine at minimum cost. You gain the economy of a "standard" machine up to the point of where you need to adapt it to "special" conditions.

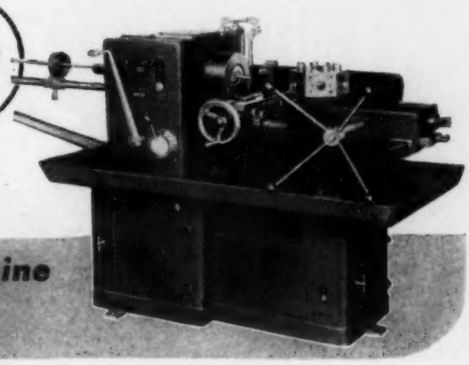
The Oster No. 601 "RAPIDUCTION" is still obtainable with either the automatically indexed, 6-position turret or with plain saddle and single tool post. But those are only two of many possible adaptations of the basic machine. Either lever or screw feed cross slides are available as well as a wide variety of air or manually operated chucking equipment.

If you believe (as many others have) that this basic machine merits careful consideration, address your inquiry to . . .

THE OSTER MANUFACTURING CO.
2058 East 61st Street • Cleveland 3, Ohio, U.S.A.

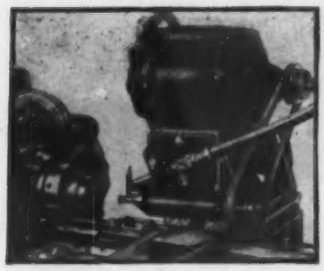
OSTER

AS A TURRET LATHE

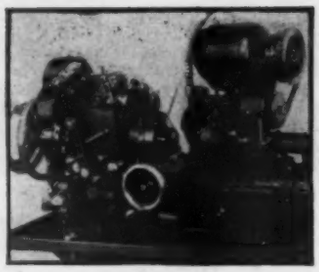


"Rapiduction"

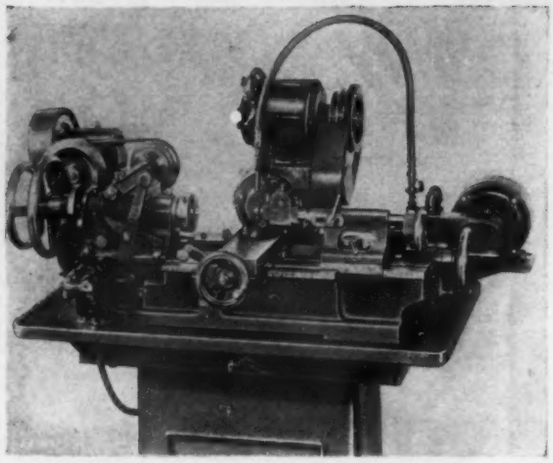
The STANDARD Turning Machine with CUSTOM-BUILT Features!



Machine equipped with Internal Milling Attachment



Machine equipped with Relieving Head



ALL STANDARD FORMS OF THREADS CAN BE PRODUCED TO CLOSEST TOLERANCES ON

WALTHAM THREAD MILLERS

Three motors on these machines provide a wide flexibility in operation as well as a constant supply of coolant for all requirements. By simply changing ratios, speeds are suitable for cutting either brass or steel. Waltham can furnish cutters for any thread form desired.

Machines are mounted on cabinet base with two shelves inside. Standard equipment includes: three motors with push button start and automatic or push button stop—follow rest—one milling cutter—indexing device for cutting multiple threads—5 pitch lead screw—change gears for cutting from 5 to 40 threads per inch.

Special Equipment Extends Utility

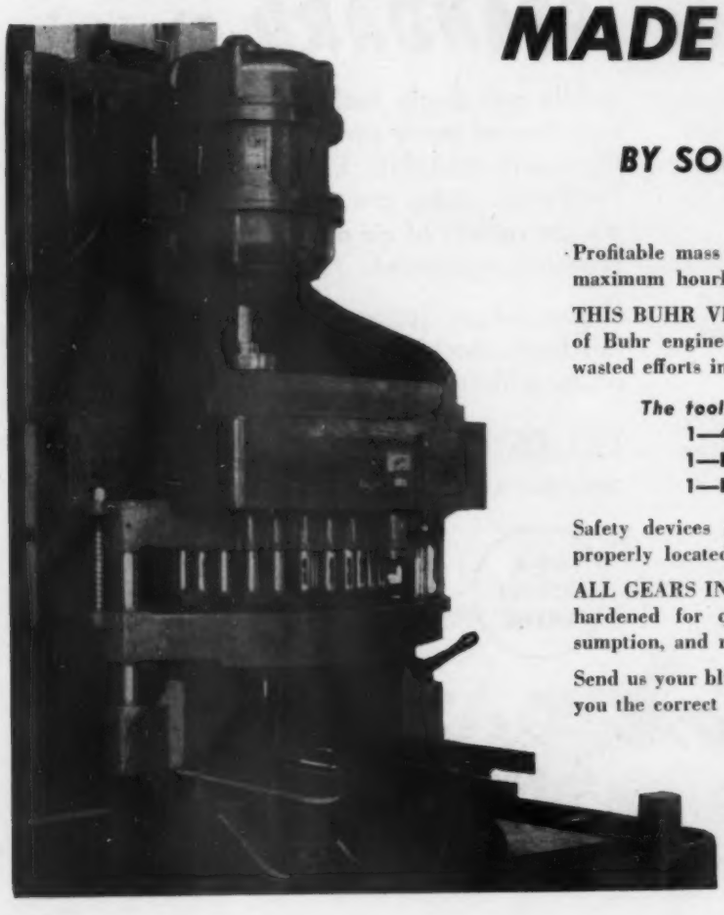
Extra equipment includes: a special work head for relieving—a special motor driven cutter head for internal threading—a multiple cutter threading attachment—automatic cam operation—special tailstock for multiple cutter work—translating gears for cutting metric threads—metric lead screw—plain taper attachment.

Write for Bulletin 244A giving detailed information.

WALTHAM MACHINE WORKS

WALTHAM, MASS.

WALTHAM TRADE MARK REGISTERED U.S. PAT. OFF.



MADE FIT FOR PROFIT

BY SOUND *Buhr* RETOOLING

Profitable mass production means equipment must be tooled for maximum hourly capacity.

THIS BUHR VERTICAL HYDRAULIC DRILLER is an example of Buhr engineering capabilities — there is no lost motion — no wasted efforts in operations.

The tooling by Buhr includes

1—41 Spindle Drill Head
1—Bushing Plate
1—Holding Fixture

Safety devices prevent machine from operating until fixture is properly located.

ALL GEARS IN BUHR DRILL HEADS are shaved and induction hardened for quieter, frictionless operation, lower power consumption, and more trouble free production hours.

Send us your blue prints or write about your problems. We'll give you the correct answer.

BUHR MACHINE TOOL CO.

837 GREEN
ANN ARBOR, MICH.

A NEW MARK IN AMERICAN INDUSTRY

A NEW symbol of industrial importance appears on the scene. Rockwell Manufacturing Company . . . soundly managed . . . closely integrated . . . alert . . . aggressive, brings together ten successful enterprises that for many years have served a diversity of basic needs and markets.

Strong today, Rockwell Manufacturing Company will grow in stature—for the individual efforts of its Divisions and Subsidiaries will be coordinated and strengthened by the collective vision, research, productive capacity, and distribution facilities of the group as a whole.

Rockwell Manufacturing Company—today a new name in American industry—planning ahead that tomorrow will find its distinctive trade mark a nationally recognized symbol for excellence on an increasingly long list of products.

PARENT ORGANIZATION FOR

PITTSBURGH EQUITABLE METER DIVISION Pittsburgh, Pa.	THE DELTA MANUFACTURING COMPANY Milwaukee, Wis.		ROCKWELL INTERNATIONAL CORPORATION New York, N.Y.
NORDSTROM VALVE COMPANY Pittsburgh, Pa.	EDWARD VALVES, INC. East Chicago, Ind.	ROCKWELL MACHINE COMPANY Hopewell, N.J.	ARCADE MANUFACTURING DIVISION Freeport, Ill.
THE CRESCENT MACHINE COMPANY Leetonia, Ohio	THE V & O PRESS COMPANY, INC. Hudson, N.Y.		MONESSEN FOUNDRY & MACHINE CO. Monessen, Pa.

ROCKWELL MANUFACTURING COMPANY

EXECUTIVE OFFICES

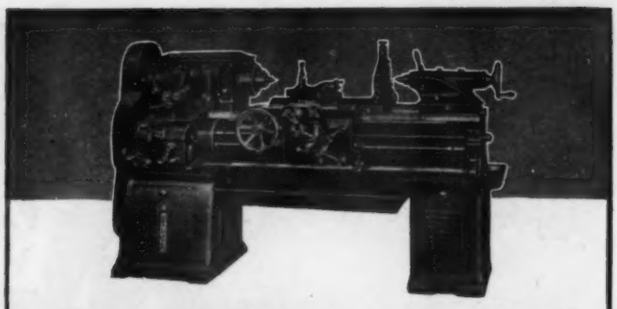
400 NORTH LEXINGTON AVENUE, PITTSBURGH 8, PA.

FENN-BUILT
SPECIAL MACHINERY
Makes Better Products Faster and Lowers Production Costs

The Aircraft Industry is but one of many diverse industries for which Fenn has created and built Special Production Machinery.

Fenn-Built Special Machinery always results in profitable operations for the user. Fenn does not tackle a job unless they can assure the prospect that new machinery will lower his costs, increase his production, or do a better job. Why not explore these possibilities with FENN. There is no obligation. Write to Dept. A for further information.

THE FENN MANUFACTURING CO.
HARTFORD, CONNECTICUT



BRADFORD *Metalmaster* LATHE
have this standard equipment

- 12-Speed Timken Geared Headstock
- Quick Change Gear Device
- Double Wall Apron
- Tailstock
- Compound Rest
- Tool Post with Ring, Wedge, Square
- Steady Rest
- Face Plate
- Dog Plate
- Head Center Bushing
- Chasing Dial
- 2-Centers
- Wrenches
- Motor Mounting and Wiring
- Push Button and Starter
- Vee Belt Drive
- Automatic Lubrication in Head
- Cabinet Legs on Head and Tailstock End of Bed
- Lever Control for Length and Cross Feeds
- Mechanical Apron Clutch Control
- Threaded Spindle Nose

The BRADFORD MACHINE TOOL CO.
1840—1945 CINCINNATI, OHIO

No Centering, holding or chucking on the "PRODUCTION" No. 101

This Centerless Feed Polishing machine assures better finishing at lower costs. Operation is extremely simple. Work is just fed automatically, and requires no centering, chucking or holding. It is ideal for polishing tubes, rods, bars and similar cylindrical work.

Features include ball bearing shaft, V-belt drive, adjustment of feed to meet diameter of work and wheel trueing while in operation.

Write for complete details

PRODUCTION MACHINE CO.
Manufacturers of Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

GOOD PRODUCTION-
CLOSE ACCURACIES-
...with a moderate investment!

ON a wide variety of parallel-surfacing operations, that require only average production rates, but tolerances even in "tenths", GARDNER *Hand-Operated* DOUBLE GRINDERS are handling the work at a minimum outlay for equipment. The economy and efficiency of GARDNER flat-surfacing operations are enabling manufacturers to adopt modernized production methods that keep pace with peacetime competition.

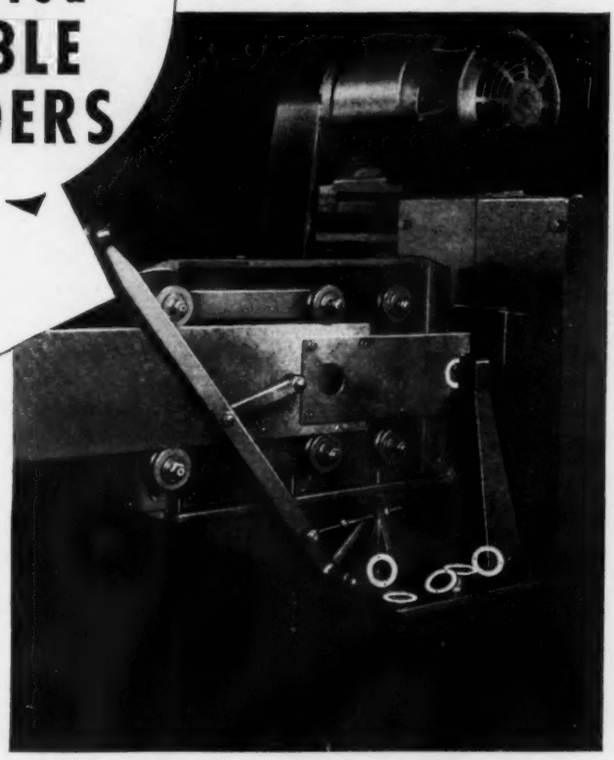
GARDNER Hand-Operated DOUBLE GRINDERS

The two representative jobs shown here indicate some of the possibilities of GARDNER DOUBLE-GRINDING.

ABOVE: Small Steel Plugs, ground on parallel faces on a GARDNER No. 77A-12" GRINDER, using hand-operated roller gun-type sliding fixture.

PRODUCTION: 4 to 6 pieces per minute.

TOLERANCES: .0005" for parallelism and .003" for uniformity.



AT RIGHT: Thin Copper Alloy Washers, 2 1/4" O.D., 1 15/32" I.D., x .045" thick, are finish ground after hardening, on a GARDNER No. 125-23" *Precision* GRINDER. A hand-operated roller gun-type sliding fixture produces 4 to 6 pieces per minute.

TOLERANCES: .0002" to .0003" for parallelism.

Write today for our DOUBLE-GRINDING Bulletins!

GARDNER MACHINE COMPANY
410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.

For Maximum Production!

Here is the Point!

Needed For More Holes Per Grind

To get maximum efficiency and longer life from Drills depends on proper grinding of the drill's point. To be accurately ground, drill grinding machines must be used—Drills sharpened on Oliver's Drillpointer give balanced cut with each lip doing equal work, sustaining longer life to both drills and equipment.

More Holes Per Grind Means Savings in Equipment

OLIVER'S 510 DRILLPOINTER

covers the entire range of Drills from ¼" to 3", providing points that give greater clearance with less chisel point angle—thrust is reduced—uniformity maintained—each drill point is exactly the same as every other drill point—Test the Oliver Drill Point on your multiple spindle equipment.

OLIVER INSTRUMENT CO.
1414 E. MAUMEE STREET • ADRIAN, MICH.

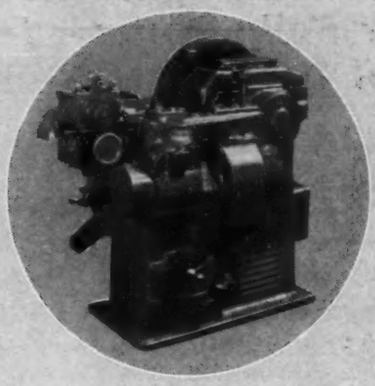
Don't Neglect Your Toolroom It's the Backbone of Production!

SEND FOR ILLUSTRATED CATALOG

OLIVER OF ADRIAN PRODUCTS

Oliver OF ADRIAN

AUTOMATIC DRILL GRINDERS—TOOL AND CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES



THE NEW NATIONAL COLD HEADER

has been adopted by over 200 Producers. They are the Who's Who of the Bolt and Rivet Industry.

These ultra-modern machines are available in single and double blow, solid and open die, and short and long stroke.

There are over 50 types and sizes.

NATIONAL

MACHINERY COMPANY

TIFFIN, OHIO

New York Detroit Chicago

A NEW Grobet SHIPPING FEATURE

Smallest Shipments Now Fully Protected Until Used - - -

A special tough adhesive paper is now used for wrapping each and every Grobet Rotary File in orders too small to ship in special all-purpose storage boxes.* This wrapping assures that the files will arrive in perfect condition—sealed against scratching—sealed against the elements.

This special Grobet wrapping, a long desired protection for "loose" shipments and small stock handling is another reason for buying GROBET ... "The Complete Line" of Rotary Files in Mill Cut, Ground Cut and Hand Cut for work on hard and soft metals, wood, rubber, plastic.

Send for Catalog R.

*All purpose wrapping container for order of from 50 to 100 Grobet Rotary Files.

GROBET FILE CO. of AMERICA

421 Canal Street — **New York, 13 N. Y.**

IMPORTERS OF GROBET SWISS FILES — MFRS. OF GROBET ROTARY FILES

Plants: New York • Chicago • Los Angeles

GROBET SWISS FILES

Since 1812

OVER 500 SHAPES AND SIZES

You will want this complete catalog of some 5,000 different sizes, shapes, and cuts of the Original Precision Made GROBET SWISS FILES made of chrome steel for higher cutting speed and durability.

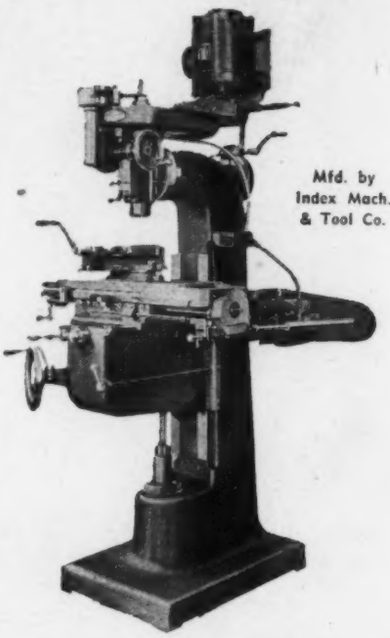
ASK FOR CATALOG BF, also request catalog BM of files and saws for filing machines.

GROBET FILE CO. OF AMERICA

421 Canal Street — New York 13, N. Y.

INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. *Literature promptly mailed on request.*



Mfd. by Index Mach. & Tool Co.

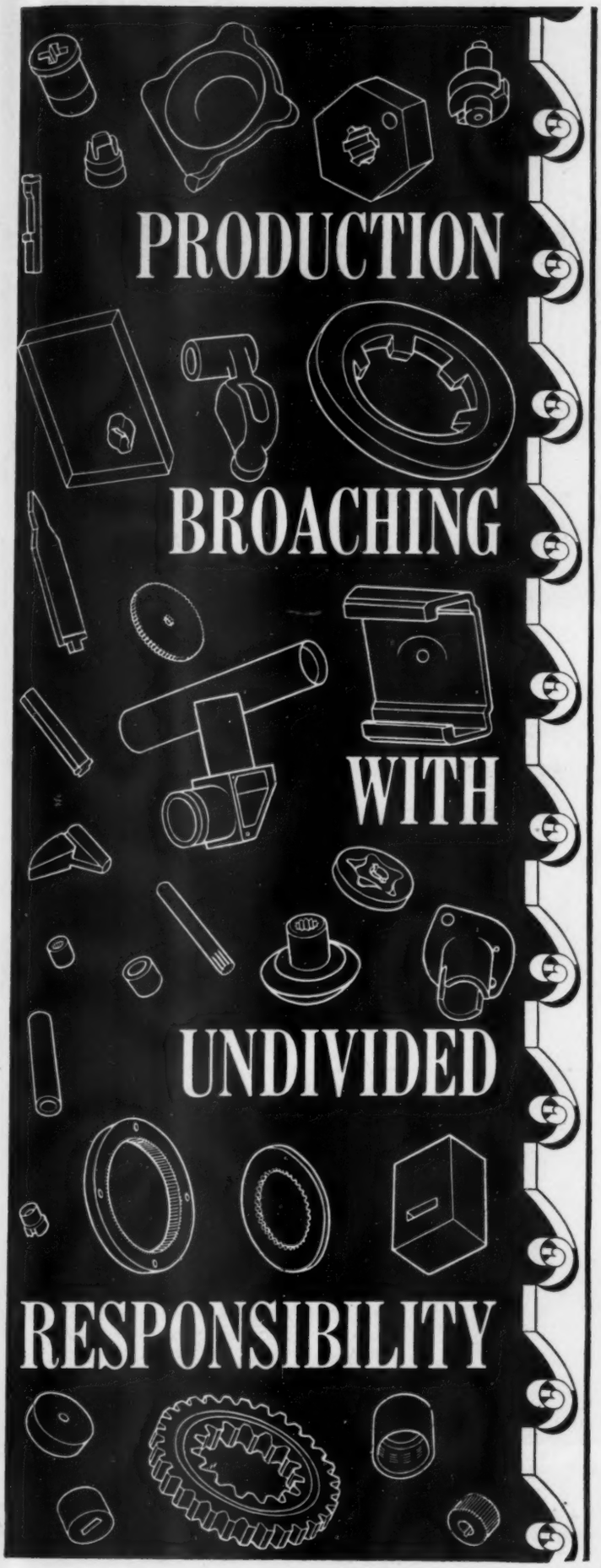
12" Tool Room Rotary Table

A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.



THE largest plant of its kind in the world is ready now. **Michigan has a new and completely equipped plant for *diversified commercial Broaching.* When BROACHING is indicated in your postwar "Processing" don't substitute costly machining methods.**

If you don't have equipment.
If your equipment is filled up.
If in a hurry to get started.
If you have complicated jobs.
If runs are too short to tool up.

Let MICHIGAN engineer the job — design and build the tools — broach the part — and do it all with UNDIVIDED RESPONSIBILITY.

WE DESIGN — BUILD — RECONDITION AND USE BROACHES

We design and build every type and size of broaches—broaching fixtures—involute gages (plug and ring) arbors —holders and pullers for broaching.

Michigan specializes in broach reconditioning and resharpening

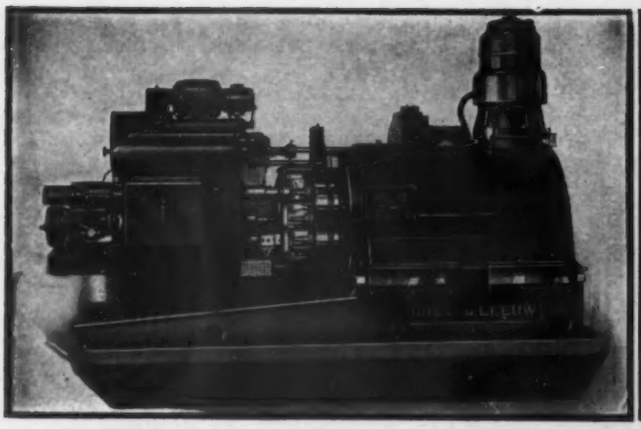
M B C
BROACHING SIMPLIFIED

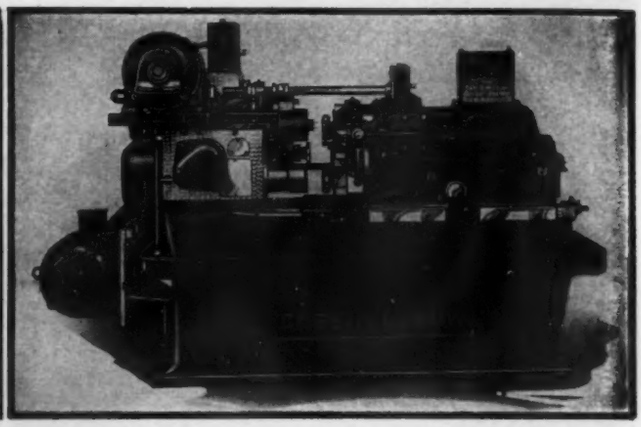
Production Broaching Division

MICHIGAN BROACH COMPANY

10371 NORTHLAWN AVENUE
DETROIT 4, MICHIGAN

For complete information on Production Broaching, send your parts prints and production requirements to Department P, Michigan Broach Company.





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

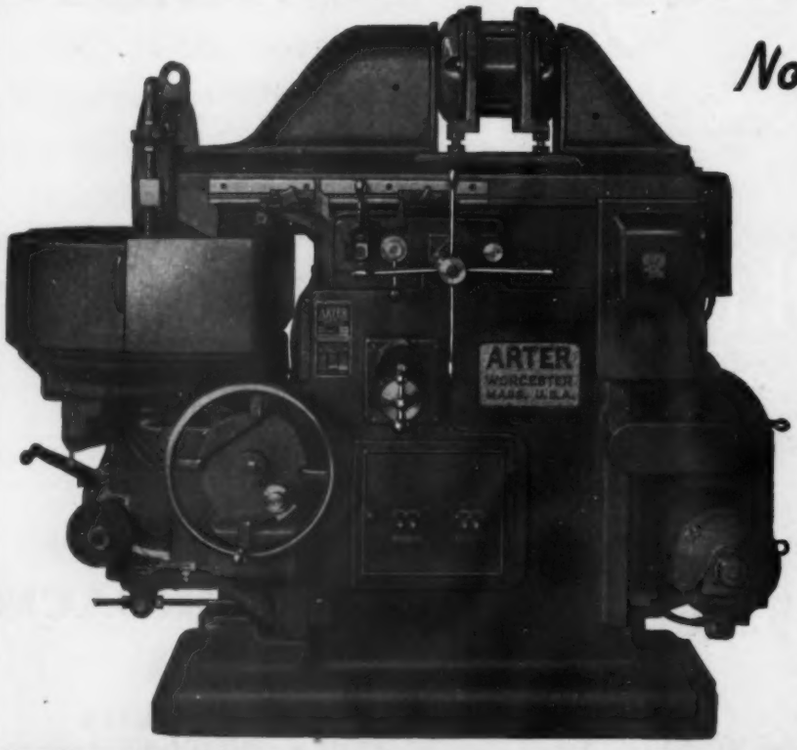
4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.



Now in Production

ARTER MODEL D

12" and 16"

Rotary Surface Grinders

Improvements and refinements that insure work being ground to extreme precision and high finish are outstanding features of this grinder, held back by war restrictions, but now available. ARTER engineers will be glad to analyze your products and point out to you how this grinder can meet the most exacting requirements of your own surface grinding.

Wheel slide hydraulically operated, with piston rod and wheel spindle axis level with the longer, front extended, widened ways, gives smoothness to the traverse and stability to the spindle. Chuck spindle mounted top and bottom in double-row, precision, preloaded ball bearings, driven by V belts from electric motor varispeed drive unit. Balanced motor mounted directly on the slide delivers full power to wheel spindle. Chuck spindle speed 60 to 250 r.p.m.

ARTER GRINDING MACHINE COMPANY
WORCESTER, MASSACHUSETTS • U. S. A.

ANOTHER LINCOLN PARK "FIRST"

Made of
CARBOLOY
CEMENTED CARBIDE

REVERSIBLE WIRE TYPE PLUG GAGES

For the first time, American industry is now offered the many advantages of reversible wire type plug gages made of Carboloy cemented-carbide in a full range of sizes. These gages, being produced by Lincoln Park Industries, have a size range from .025" to .375" and are made to Class XX and X tolerances.

Provide These Unusual Features

- Solid Carboloy wire type gage members assure long, accurate gage life—at least fifty times that expected of similar members made of steel.
- Wear-resistance allows users to disregard wear allowance for gage life and take advantage of full print tolerance.
- High elastic limit of Carboloy insures against bent and deformed wires.
- Being non-corrosive they will not rust in the handle or in storage.
- Since Carboloy is non-magnetic, the gages will not pick up chips or other metallic substances which might scratch work.
- They are easily adjusted for length by loosening nuts in ends of handle and can be cut off as worn or reversed in handle as required.
- All handles are of collet type and are made of metal throughout, assuring maximum strength and durability. They are not affected by oils, etc.
- Light weight flexible all-metal handles are supplied for sizes up to 3/16". This feature of flexibility reduces hazard of breakage due to accident or rough handling.
- Solid handles for sizes over 3/16" are made of aluminum, providing ease of handling and corrosive resistance.

Lincoln Park **INDUSTRIES, INC.**

1721 FERRIS AVENUE • DETROIT 25, MICHIGAN

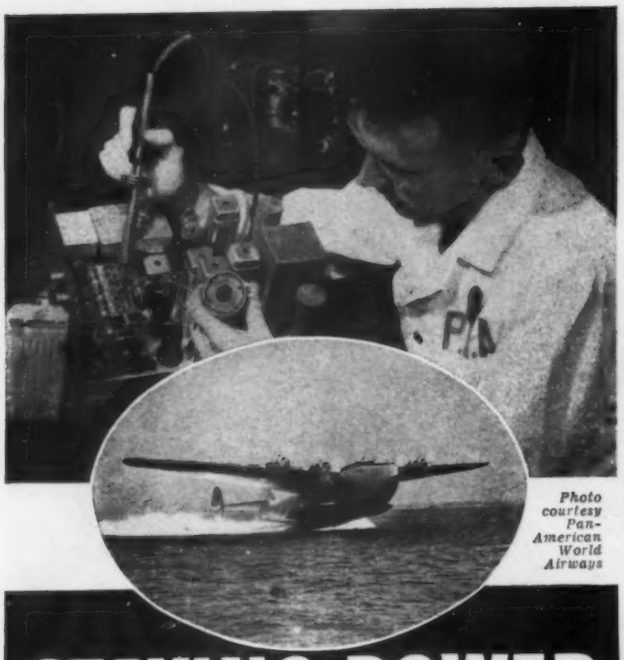


Photo courtesy Pan-American World Airways

STAYING POWER *Anywhere*

with KESTER Cored Solders for Long-Range Performance

● The rugged dependability and staying power proved by Kester Cored Solders in dozens of applications aboard the globe-circling Flying Clippers of Pan American World Airways, are the same characteristics which make them the No. 1 choice throughout industry.

● Tested, time and again, under all possible operating conditions, Kester solder-bonds hold tight—permanently—against shock, vibration, bending, and the contraction and expansion of temperature extremes.

● Kester Cored Solders are virtually mistake-proof and trouble-free as well, for the flux-filled cores are scientifically balanced with superior alloys—ready to apply in one simple operation.

● Kester Rosin-Core Solder, for electrical connections, will not cause corrosion nor harm insulation. Kester Acid-Core Solder, for general work, is an ideal all-purpose solder.

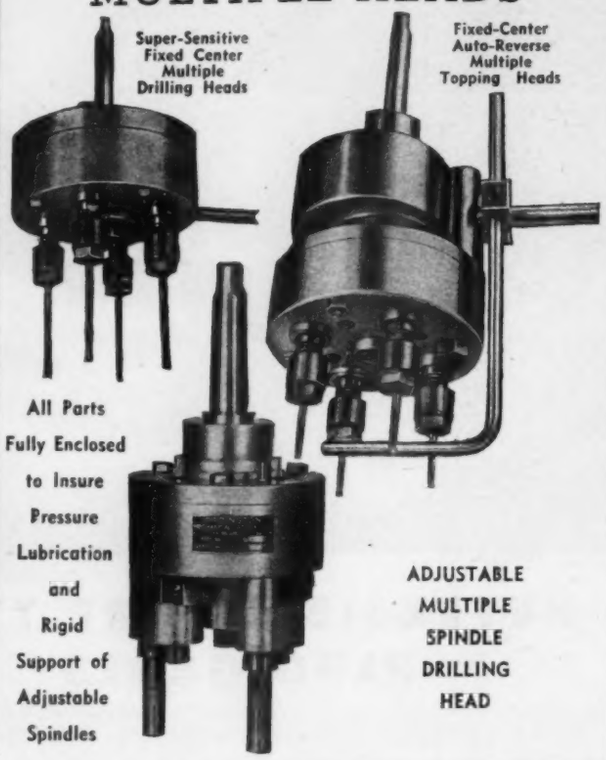
● Kester engineers, backed by 47 years of practical experience and laboratory research, are at your service any time. They will gladly work out any solder problems you may have—and at no obligation.

KESTER SOLDER COMPANY
4223 Wrightwood Ave., Chicago 39, Illinois
Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER
Cored Solders
STANDARD FOR INDUSTRY

ERRINGTON MECHANICAL LABORATORY
STAPLETON, STATEN ISLAND 4, N. Y.

MULTIPLE HEADS



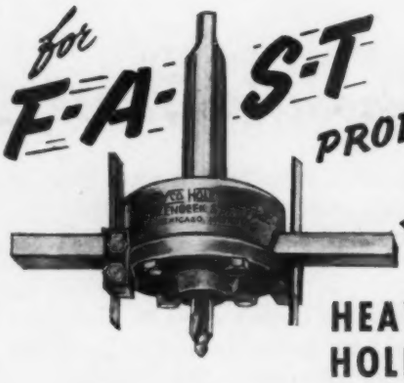
Super-Sensitive Fixed Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Topping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

for **F-A-S-T** *PRODUCTION*



WYCO

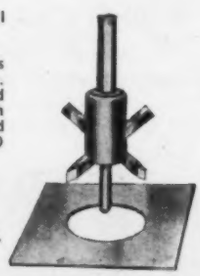
HEAVY DUTY HOLE CUTTER

Quickly adjustable from 4½" to 10" Diameters.

Fits 1" Drill Chuck, or can be ordered with Morse Taper Shank. Heavy duty tool. Cuts absolutely clean round holes or washers from steel plate or other material up to ½" thickness. Cuts as accurately to size as a boring tool. Tool holders and body heavy steel—very rigid. Has 2 standard high speed cutting off blades for balanced cut. ½" hardened pilot pin. Shanks interchangeable. Complete with ⅞" hexagon shank, fitting any 1" drill chuck, or with No. 3 or No. 4 Morse Taper Shanks.

WYCO HOLE CUTTER for electric drill, drill press, or carpenter's brace.

Fits any ½" drill chuck. Self tightening. Cuts round holes in sheet metal, bakelite, fibre, etc. No clamps, wedges nor screws. Use standard drills and tool bits. Cutter bits standard high speed lathe bits. Easily sharpened. Can be used with pilot drill. Send for Complete WYCO Catalog.



WYZENBEEK AND STAFF, Inc.
830 W. Hubbard St. Chicago 22, Ill.
Makers of Profit-Producing Tools

Eliminated a honing operation ... made job profitable

Stanicool HD Soluble Oil fits the in-between-jobs where cutting oil does not give sufficient cooling and a conventional soluble oil does not give satisfactory tool life and finish.

STANICOOL HD
SOLUBLE OIL

JUST A CHANGE in the soluble oil used in machining a small pump cylinder eliminated a honing operation for a Michigan machine company. The change moved the job from the unprofitable to the profitable side of the ledger.

The pump cylinders were grey iron castings. They were drilled and reamed and then, in order to get a smooth, clear inside surface, a seven minute honing operation was required. A conventional soluble oil was being used.

Then Stanicool HD was given the job. This heavy duty soluble oil contains special extreme pressure additives. With it, the finish on the cylinder after drilling and reaming was so excellent that only a slight burnishing operation was required to make it mirror-like.

This is a typical report from a Standard Cutting Oil Specialist. It illustrates the many and varied savings that can be made when you call in one of these specialists. Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Ill., for the Cutting Oil representative nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Class	Type	Kind of Soap	Upper Temp. Limit	Characteristics
Lime Soap (Calcium)	Cup	Lime fat	175° F.*	Smooth, water resistant, separates on boiling out water content, limited consistency loss on working.
	Axle	Lime rosin	150° F.	Smooth, sticky, water resistant, separates on boiling out water content, great consistency loss on working.
Soda Soap	Fibre and Sponge	Soda fat	375° F.	Fibrous, not water resistant, does not separate at elevated temperatures, variable consistency loss on working.
	Medium and Short Fibre	Soda fat	375° F.	Semi-smooth, not water resistant, does not separate at elevated temperatures, variable consistency loss on working.
	Smooth (block, brick)	Soda fat (variable soda rosin content)	400° F.	Smooth, hard, not water resistant, does not separate at elevated temperatures.
Aluminum Soap	— — —	Aluminum fat	240° F. (average)	Smooth, gel-like or stringy, water resistant, becomes fluid at elevated temperatures, limited consistency loss on working.
Compounds	Residuum	Usually none	— —	Smooth, black, adhesive, excellent pressure and water resistant.

*As high as 200° F. for special lime soap greases where such maximum temperature is intermittent.

To get longer life from bearings

(1) Use the right grease

The difficulties of choosing the right type of grease for any particular application are demonstrated in the table above. This lists the general operating characteristics of the more common types of grease. In addition, each type comes in many grades and all have advantages for specific grease lubricating jobs.

Many plant men have given up trying to guess their way through this maze. They know that Standard Oil makes all types of grease. They've found that Standard Oil Lubrication Engineers are qualified by training and experience to analyze operating conditions and fit the right type and grade of grease to the job. But the right grease is only half the problem. The other is:

(2) Good Maintenance Practices

The proper functioning of even the best grease in a bearing depends upon many factors such as condition of seals, bearing alignment and lubricant application, to name a few. A common tendency, for example, is to apply too much grease to anti-friction bearings. This results in excessive churning of the grease, undue friction and leakage.

Here again a Standard Oil Lubrication Engineer can help you by determining the cause of bearing or lubricating failures. Put your lubricating problems into the hands of one of these Lubrication Engineers. Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill., for the Engineer nearest you.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

A DOUBLE SAVING with SCULLY-JONES Style "A" TAP CHUCKS

① **Reduce tap breakage and time lost for changing.**

② **Speed up production by quick insertion and ejection.**

See pages 25, 26, 27, Scully-Jones Catalog No. 500

In a standard spindle with a Morse Taper Hole

In Scully-Jones Floating Holder

In Floating Tension Type Tap Driver for Magic Chuck

In a Magic Quick Change Chuck

In a Spring Compression Tap Driver

Universally used for individual or modern mass production, the Scully-Jones Style "A" tap chuck is a one-piece tool designed for driving taps in any type of machine having a spindle, holder or attachment with a Morse taper hole.

True-running, definite stop, positive drive, smaller in diameter than spindle, quick insertion and easy ejection, are advantages that reduce tap breakage and speed up production.

Write for our complete listing of sizes.

5 Big FEATURES

STYLE "A" TAP CHUCKS

1. Drives By Square—a positive drive
2. Centers By Shank—for correct alignment
3. Collet Action—locks tap in chuck
4. Taper Shank—fits any M.T. hole
5. Four Point Bearing—gives collet action

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

1902 SOUTH ROCKWELL STREET • CHICAGO 8, U. S. A.

For better seeing... better feeling... better drilling

BECAUSE THEY'RE BUILT THAT WAY

HAMILTON *Sensitive* MACHINES

meet every test of dependable, economical performance in which utmost precision and sensitivity are paramount. Designed by the Hamilton engineers to do every job *right!*

Hamilton
SENSITIVE TAPPER

More units per hour. For tapping operations on instrument, camera, watch, clock, business machines and all other precision work. Smooth, easy operation without breakage of even the smallest taps.

Fool-proof; noiseless-head mechanism is completely hooded so operator is protected from oil and dirt.

For any threadable material. From smallest and finest thread, up to and including 10-32.

Hamilton
"VARIMATIC"

Super-Sensitive Drilling Machine for small holes .004" to 5/16" diameter

Two speed ranges, infinitely variable. Built with "instrument precision" for finest drilling in tool rooms, Diesel, instrument, electrical, aircraft and other uses. Bold in design, sturdy, convenient, perfectly constructed. Self-contained drilling unit swings radially on column and locks to any position.

From 840 to 9300 r.p.m.

Hamilton
"MAXI-JR-E"

Super-Sensitive Drilling Machine for small holes .004" to .250" diameter

May be used singly or in gangs. Possible spindle speeds from 750 to 12,000 r.p.m. Full floating spindle designed to eliminate radial belt pull on the spindle. Within its capacity the extreme flexibility of MAXI-JR-E meets all requirements conveniently and economically.

WRITE FOR NEW BULLETINS

THE
HAMILTON TOOL CO.
HAMILTON, OHIO

KEYSEATING
The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY
403 EXCHANGE ST. ROCHESTER 8, N. Y.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V&O Press Co.
HUDSON, N. Y.

Sensitive
DRILLING MACHINES
Avey
CINCINNATI OHIO

MILLHOLLAND

Automatic DRILLING - BORING MILLING - TAPPING *Units*

½ to 20 HORSEPOWER DRIVE

AUTOMATIC and SEMI-AUTOMATIC PRODUCTION MACHINERY

W. K. MILLHOLLAND MACHINERY CO.
Indianapolis, Ind.

Knock-Out EXPANDING MANDRELS

They're fast! They're accurate! They're economical!

CAN BE PURCHASED SINGLY OR IN SETS

MODEL NO.	CAPACITY
M0	3/8" to 1/2"
M1	1/2" to 11/16"
M2	11/16" to 1"
M3	1" to 1 9/16"
M4	1 9/16" to 2 1/2"
M25	11/16" to 27/32"
M26	27/32" to 1"
M35	1" to 1 9/32"
M36	1 9/32" to 1 9/16"
M45	1 9/16" to 2 1/32"
M46	2 1/32" to 2 1/2"
M5B	2 1/2" to 3 1/4"
M5C	3 1/4" to 4"
M55	3 1/4" to 4 3/4"
M6B	4" to 4 3/4"
M6C	4 3/4" to 5 1/2"
M7	2 1/2" to 5 1/2"

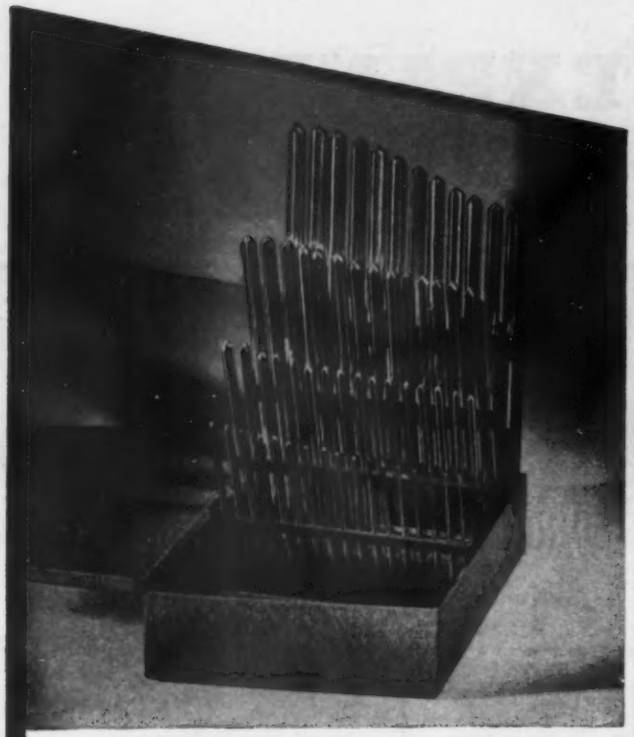
IF IT'S MADE BY LEE

IT'S A *Knock-Out*

SEE YOUR NEAREST DISTRIBUTOR

OR WRITE TO **K. O. LEE CO.**

1127 1st AVE. S. E., ABERDEEN, SO. DAK.



A Standful of Better Production

This matched set of sixty L & I Ground Flute Reamers in Wire Gage sizes is only part of the L & I Line of Better Reamers.

They're better, because L & I specializes in ground flute reamers — ground *after* the solid bar is heat-treated and uniformly hardened. This gives a perfect cutting edge that stands up far longer than ordinary milled flute reamers.

Because we're "Specialists in Small Reamers," we ship from stock Machine Reamers by 64's from 1/16" to 5/16" and Wire Gage sizes 1 through 60, as well as Taper Pin Reamers from 7/0 to #4.

Place a trial order today and join the long list of leaders who are cutting costs and improving work quality with L & I Ground Flute Reamers.

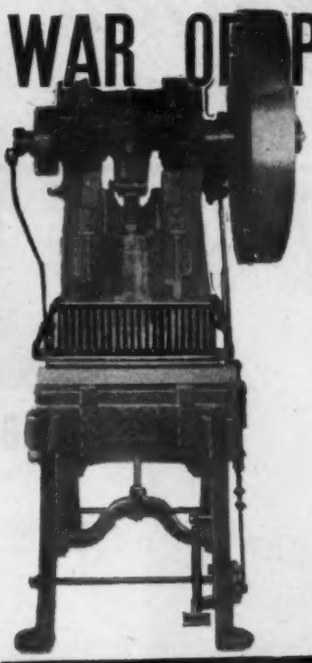
LAVALLEE & IDE, INC.

CHICOPEE, MASSACHUSETTS

2

L&I GROUND FLUTE REAMERS

STILL FIGHTING THE WAR OF PROTECTION



Equipping your stamping presses with Junkin Guards is an investment in protection for both your workers and your profits, and means lower insurance costs, increased press protection, finer plant morale. Controlling the danger of torn, lacerated operator's hands, reduces compensation costs and lost man hours. *Send for the new Junkin Catalog. There is no obligation.*

JUNKIN SAFETY APPLIANCE CO., INC.
936 West Hill Street
Louisville, Kentucky

WRITE FOR THIS NEW CATALOG

JUNKIN SAFETY GUARD

USE *Fluid-motion* for modern form-dressing

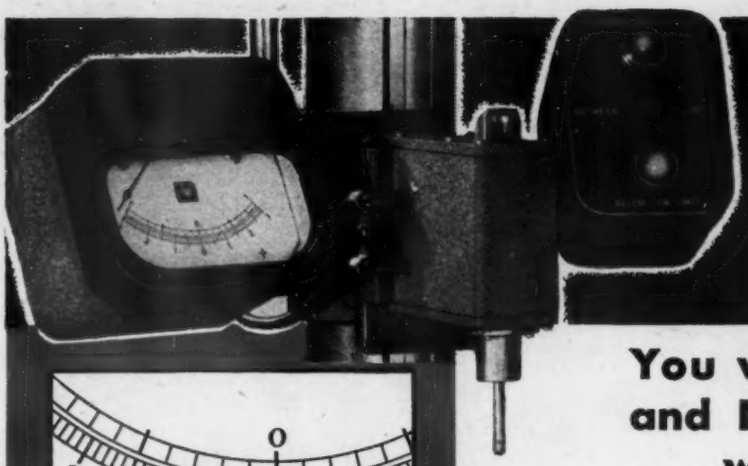
ONE SETTING HANDLE CONTINUOUS MOTION

J & S Radii & Angle Dressers in the "Fluid-Motion" series are among the finest precision dressing instruments procurable. . . . regardless of cost. There is a standard model to fit most form-dressing requirements.

FEATURES

Fluid-motion dressing
.0001" accuracy
Automatic centering
7" & 14" wheel capacities
Large range yet compact
Chatterless and dustproof

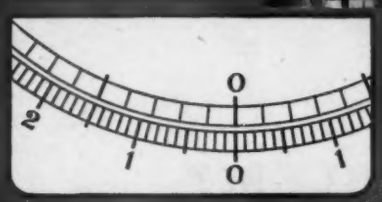
J. & S. TOOL CO.
477 MAIN STREET
EAST ORANGE 1, N. J.



Gage Electronically

You will SAVE MONEY and IMPROVE QUALITY with This Gage -

It's versatile, exceptionally accurate, sensitive, and very fast



Above section shows actual size scales. You can select any one of 4 magnifications. Minimum graduation either scale .0001" and .00001".

FOUR MAGNIFICATIONS on the Same Dial

INSTANTANEOUS LIMIT LIGHTS

One-pass inspection; no maneuvering, no backstop required.

CONTACT PRESSURE Adjustable from 1½ ozs. to 16 ozs.

Greatest sensitivity of any Gage. Overtravel does not harm gaging mechanism.

ADAPTABLE TO VARIOUS MACHINE and FIXTURE SET-UPS

Contact unit and gaging heads can be adapted to suit requirements.

USE this truly Electronic Comparator in both your shop and laboratory. Small shops find this versatility a big asset. You get two gages for the price of one.

In your laboratory, its exceptional accuracy and extreme sensitivity, the highest of any comparator on the market, will enable you to make the most precise measurements. You can check your most accurate gage blocks and masters.

It has a choice of four differently graduated scales. You are not limited to a single scale. You can read any value from .000010" to .003". Minimum contact pressure is only 1½ ozs.

You can take it out into your shop, and with a flick of a switch it is ready to inspect production having any tolerance from the finest you will ever require, to the widest.

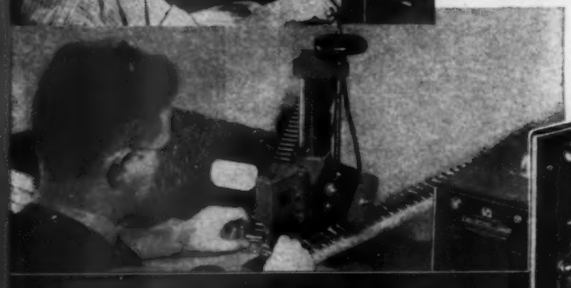
Any operator can use it. The tolerance lights obviate the necessity of reading the dial. And he can't hurt it by forcing the contact spindle.

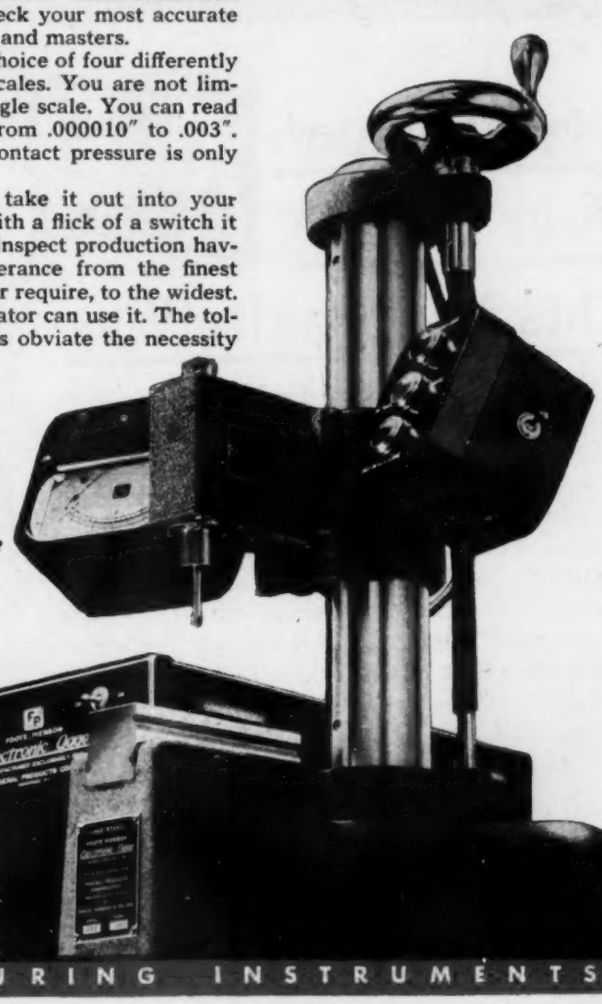
It is adaptable to various set-ups on any machine or gaging fixture.

We will tell you more about it if you will write —

FEDERAL PRODUCTS CORPORATION
1144 Eddy Street
Providence 1, Rhode Island

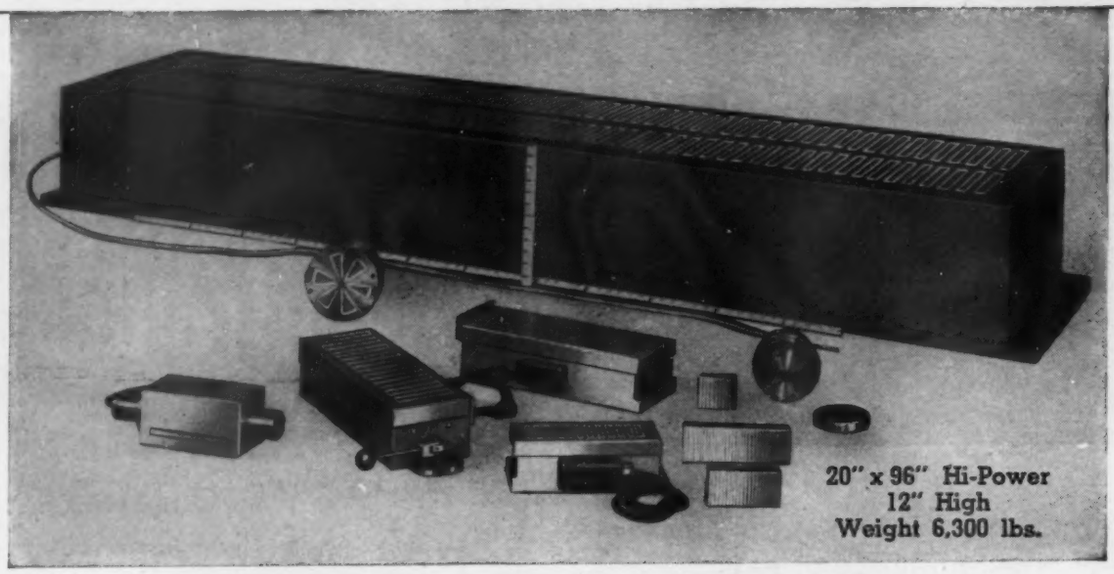
FOOTE PIERSON
Electronic Gage
MANUFACTURED EXCLUSIVELY FOR





FEDERAL

PRECISION MEASURING INSTRUMENTS



WHAT IS YOUR PROBLEM?

- The above display illustrates the diversified demand for WALKER CHUCKS.
- Increase your Productive Efficiency by the use of WALKER MAGNETIC CHUCKS.
- Less fatigue on the part of your operating personnel.
- Submit your problems to WALKER engineers for successful solution.

O. S. WALKER CO., INC.
100 ROCKDALE STREET - WORCESTER, MASSACHUSETTS
Makers of Rectangular, Swivel and Rotary Magnetic Chucks. Also Permanent Chucks.

Dry Shampoo Your Floors This New Oakite Way

The next time it becomes necessary to clean up water or oil on floor areas around and under machines, try the new, DRY method, using Oakite Composition No. 71. All you do is sprinkle or spread this dustless, granular, absorbent material over the area to be cleaned. Oil drippings, coolants, oil, etc., are completely soaked up. Oakite Composition No. 71 acts while you work . . . gives you safe footing at the same time. Your Oakite Technical Service Representative will be glad to demonstrate this new, low-cost DRY floor cleaning method without obligation. Call him today.

OAKITE PRODUCTS, INC., 24 Thames St., NEW YORK 6, N. Y.
Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* **CLEANING**
MATERIALS · METHODS · SERVICE · FOR EVERY CLEANING REQUIREMENT

BAUMBACH
STANDARDIZED DIE SETS

BETTER-MADE
DIE SETS
AT LOWER COST
46 Styles—195,000 Sizes
E. A. BAUMBACH MFG. CO.
Machined Steel Semi-Steel
Send for our new catalog
1812 South Kilbourn Ave., Chicago, Ill.

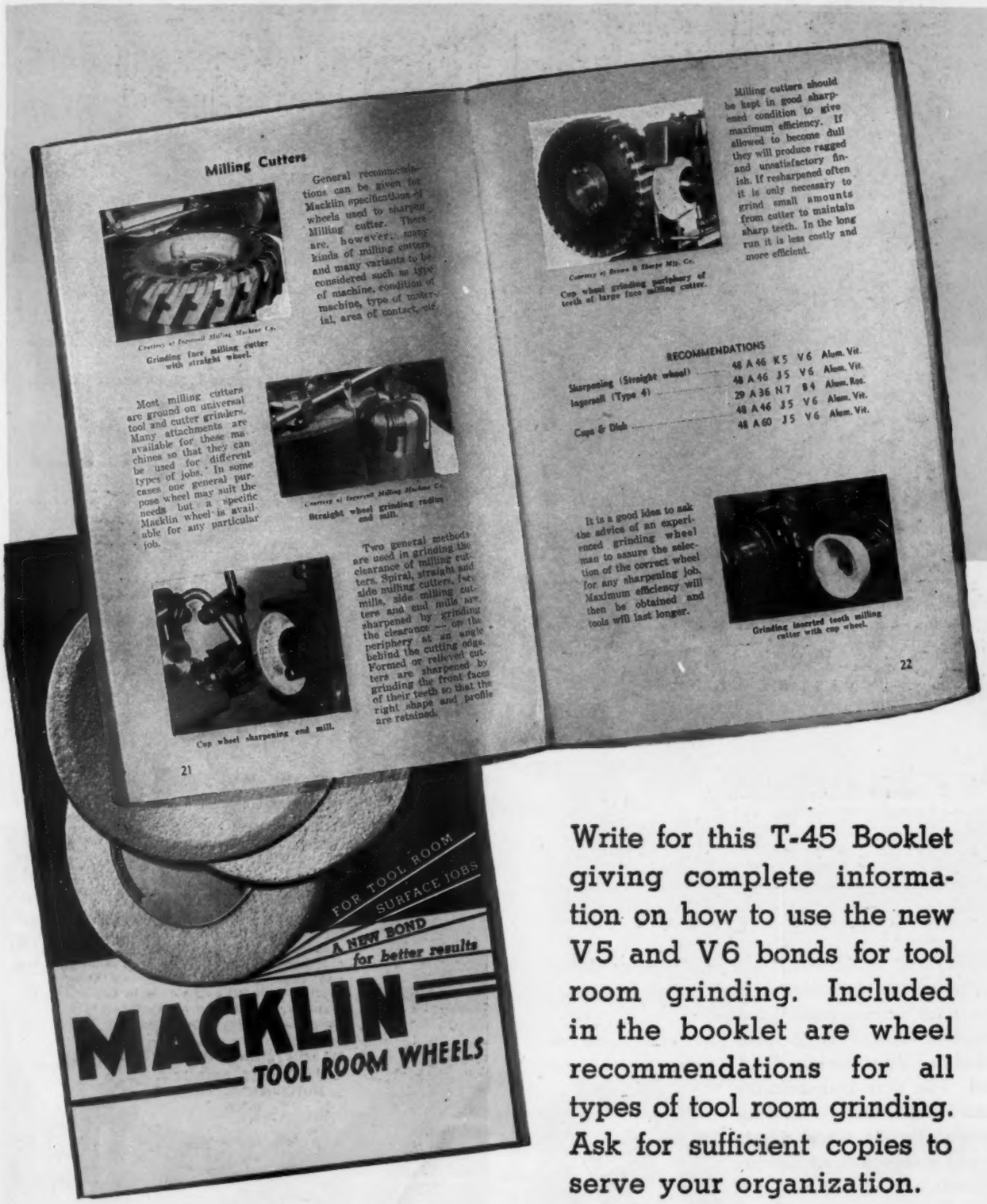
LUERS Patented Cutting Off Tool Holders
Patented Cutting Off Blades
ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.
Manufactured By
J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.
Produced under License Issued by John Milton Luers Patents Inc.

GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter, either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.


Milling Cutters
General recommendations can be given for Macklin specifications of wheels used to sharpen Milling cutter. There are, however, many kinds of milling cutters and many variants to be considered such as type of machine, condition of machine, type of material, area of contact, etc.
Grinding face milling cutter with straight wheel.
Most milling cutters are ground on universal tool and cutter grinders. Many attachments are available for these machines so that they can be used for different types of jobs. In some cases one general purpose wheel may suit the needs but a specific Macklin wheel is available for any particular job.
Straight wheel grinding radius end mill.
Two general methods are used in grinding the clearance of milling cutters. Spiral, straight and side milling cutters, fly mills, side milling cutters and end mills are sharpened by grinding the clearance — on the periphery at an angle behind the cutting edge. Formed or relieved cutters are sharpened by grinding the front faces of their teeth so that the right shape and profile are retained.
Cup wheel sharpening end mill.
21
Milling cutters should be kept in good sharpened condition to give maximum efficiency. If allowed to become dull they will produce ragged and unsatisfactory finish. If resharpened often it is only necessary to grind small amounts from cutter to maintain sharp teeth. In the long run it is less costly and more efficient.
Cup wheel grinding periphery of teeth of large face milling cutter.
RECOMMENDATIONS
Sharpening (Straight wheel) 48 A 46 K 5 V 6 Alum. Vit.
Ingersoll (Type 4) 48 A 46 J 5 V 6 Alum. Vit.
29 A 36 N 7 B 4 Alum. Rec.
Cups & Dish 48 A 46 J 5 V 6 Alum. Vit.
48 A 60 J 5 V 6 Alum. Vit.
It is a good idea to ask the advice of an experienced grinding wheel man to assure the selection of the correct wheel for any sharpening job. Maximum efficiency will then be obtained and tools will last longer.
Grinding inserted tooth milling cutter with cup wheel.
22
FOR TOOL ROOM SURFACE JOBS
A NEW BOND for better results
MACKLIN
TOOL ROOM WHEELS

Write for this T-45 Booklet giving complete information on how to use the new V5 and V6 bonds for tool room grinding. Included in the booklet are wheel recommendations for all types of tool room grinding. Ask for sufficient copies to serve your organization.

MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago · New York · Detroit · Pittsburgh · Cleveland · Cincinnati · Milwaukee · Philadelphia

A master tool for industrial workmen – plant electricians, plumbers, maintenance men, garage mechanics, and even for the handyman householder.

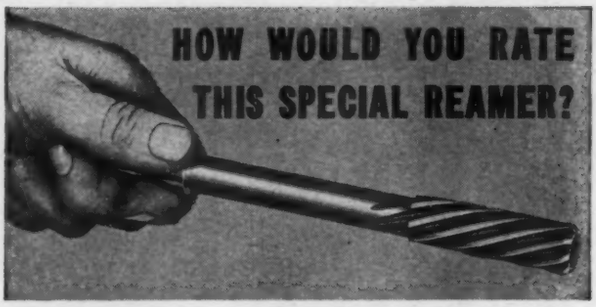
The Star "Moly*" High-Speed Steel blade is recommended for jobs where speed and accuracy must be combined. The Star Unbreakable Special Flexible blade is ideal for all-around cutting where toughness and a certain flexibility are important.

*T. M. Reg.—Blades bearing the name "MOLY" are made only by Clemson Bros., Inc., and affiliated companies.

TRADE MARK

CLEMSON

CLEMSON BROS., Inc., Middletown, N. Y.
Makers of hand and power hack saw blades, frames, metal cutting band saw blades and the Clemson D-17 lawn machine



ACCURATE to your specifications—and it can be duplicated exactly.

WORKMANSHIP—of a Quality that provides longer life.

CORRECT TOOL DESIGN—embodying all the most acceptable characteristics of design—suited to your needs.

FINEST MATERIALS—**HI-SPEED STEEL OR CARBIDE**—promoting freer cutting and long life.

SCIENTIFIC HEAT TREATING—insures long life with fewer interruptions for resharpening.

Isn't this the sort of reamer you need for your production cutting—for efficiency and economy?

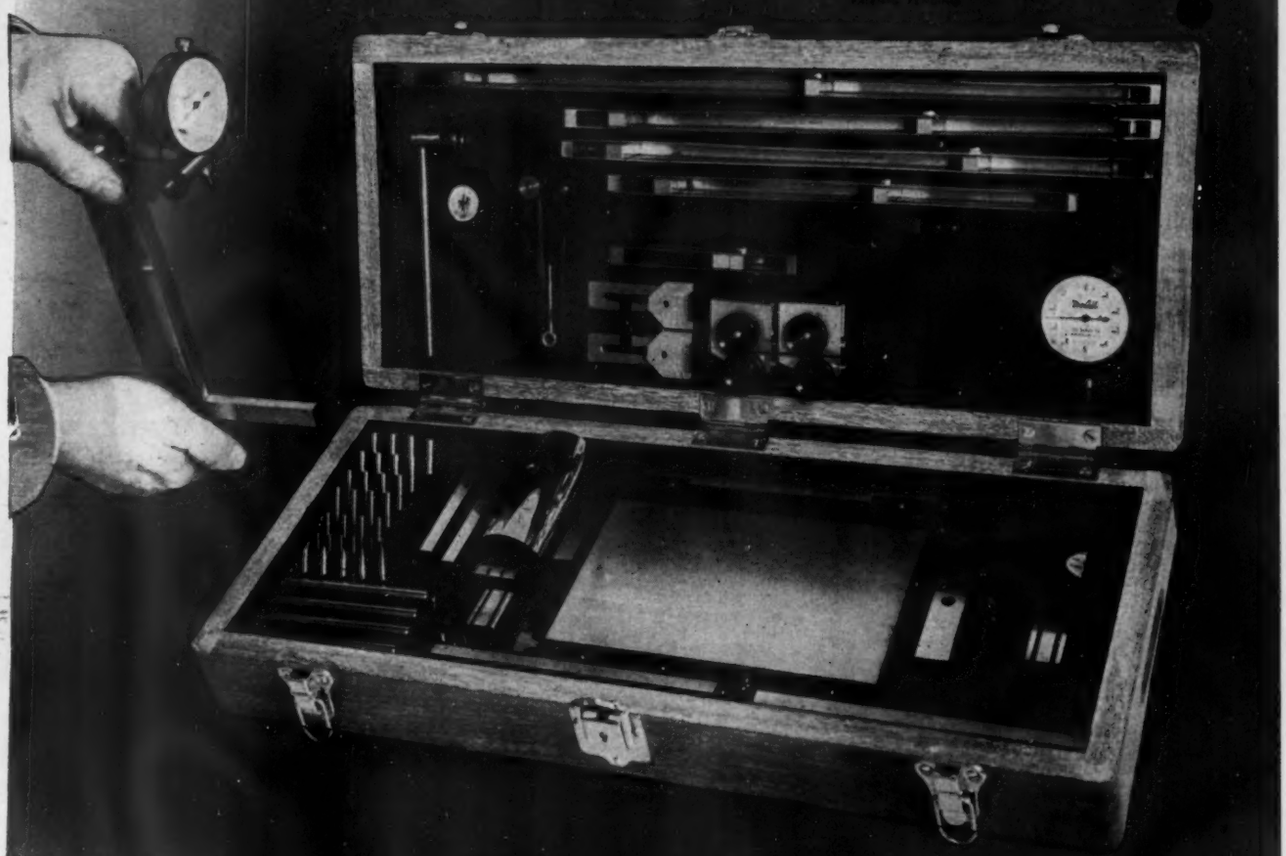
You can obtain such reamers and other special cutting tools of all types from us—quick delivery—as needed.

Send us your inquiries for prompt estimates and prices that are economical—cost per cutting hour considered. Bulletin 301 on request.

AMERICAN CUTTER & ENGINEERING CORP.
31745 Mound Road • Warren, Mich.

A.C.E. SPECIAL CUTTING TOOLS
HI-SPEED OR CARBIDE-TIPPED

A Million Precision Gages with DoALL'S "PRODUCTO-CHEK"!



Why, with recommended production tooling, building crib of costly gages for production inspection? Such stocks of single-purpose tools are today a thing of the past. Over a million gage jobs can be done with a small kit—DoALL Producto-Chek—the greatest short-cut ever devised to slash costs of production inspection.

Accurate gaging tools are assembled from Producto-Chek in a few moments. When a job is finished, parts are simply replaced in the box—no unusable gages left to write off.

Producto-Chek is used with gage blocks. It gives you highest precision gages from one set. Gives instant inspection gages of all configurations, depths, angles and multiple dimensions for duplicating bench operations in production. Includes universal calipers, height gages, plug and center gages and dozens other instruments.

Besides providing limitless types, sizes and combinations of gages, Producto-Chek makes gaging operations visual and dependable. Dial indicators show if measurements are "on the head" or "off" and exactly how much—no guesswork in squinting for square check, nor dependence on the "feel" of snap gages.

We want to show you more about Producto-Chek—Why not phone or write for Producto-Chek Circular?

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Cincinnati	MAIN 3929	Houston	C 6588									St. Louis	CE 3621	Toronto	RA 5191
Cleveland	EX 1177	Indianapolis	LI 9957	Los Angeles	TR 8713	Milwaukee	HO 5950	Montreal	HAR 4535	Orlando	6056	St. Paul	EN 2399	Tulsa	4-8841
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If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

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Card taps are sold by leading dealers everywhere

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DIVISION OF UNION TWIST DRILL CO.

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For nearly a [illegible] Matthews & Co. have been making marking devices to meet every requirement. From simple hand stamps to complex marking machines Matthews has a marking device that will answer your needs . . . economically, attractively and distinctively.

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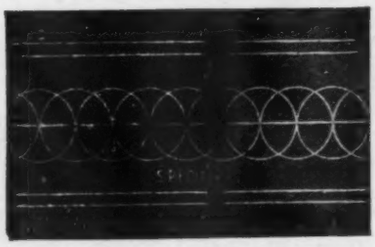
making dies & templates



simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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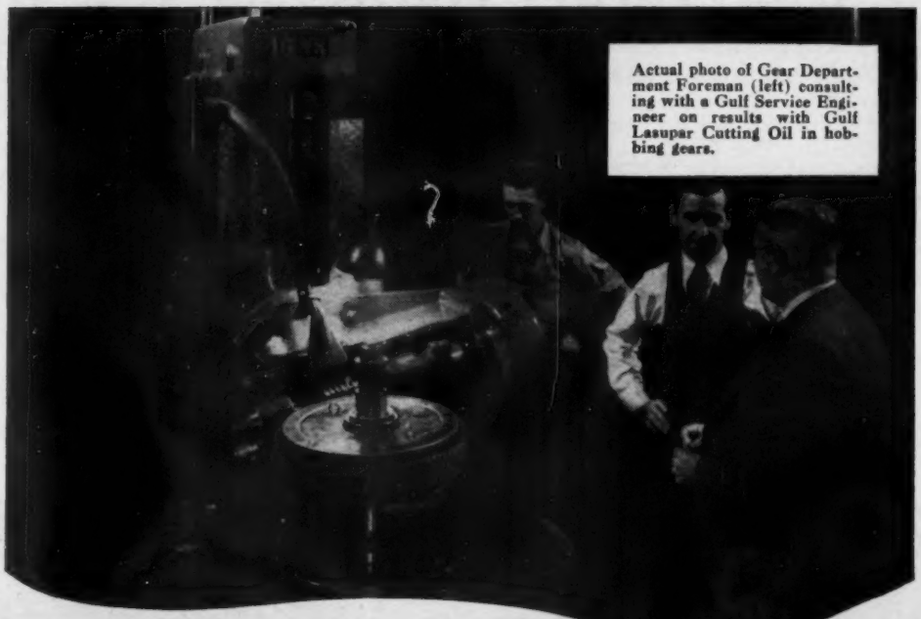

Actual photo of Gear Department Foreman (left) consulting with a Gulf Service Engineer on results with Gulf Lasupar Cutting Oil in hobbing gears.

"With Gulf Lasupar Cutting Oil

we increased production over 40% and get an extremely smooth finish"

says this Foreman

"GULF LASUPAR CUTTING OIL has proved superior to all other cutting oils we tested for hobbing gears," says this Foreman. "With this fine cutting oil, we increased production 40 per cent, and get an extremely smooth finish."

Here's a cutting oil that offers important help to you in the coming "battle of costs"! Gulf Lasupar Cutting Oil has the combination of characteristics needed to handle the modern steels. It works well at speeds once thought impossibly high. It cuts machining costs—often improves production as much as 50 per cent, and meets requirements for an exceptionally fine finish on the work.

Call in a Gulf Service Engineer today and let him demonstrate how this cutting oil can help you improve your machining practice. Gulf Lasupar Cutting Oil—and the other quality cutting oils in Gulf's complete line—are available to you through 1200 warehouses in 30 states from Maine to New Mexico. Write, wire, or phone your nearest Gulf office.

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Gulf Lasupar Cutting Oils A, B, and C
Gulf Electro Cutting Oils A, B, and C
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Gulf Cut-Aid : Gulf Cutx B : Gulf L. S. Cutting Base A and B

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Please send me, without obligation, a copy of the booklet, "Gulf Cutting Oils," which includes a helpful Machining Guide.

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Company.....

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DIAMONDS IN A

New and Improved Vitrified Bond

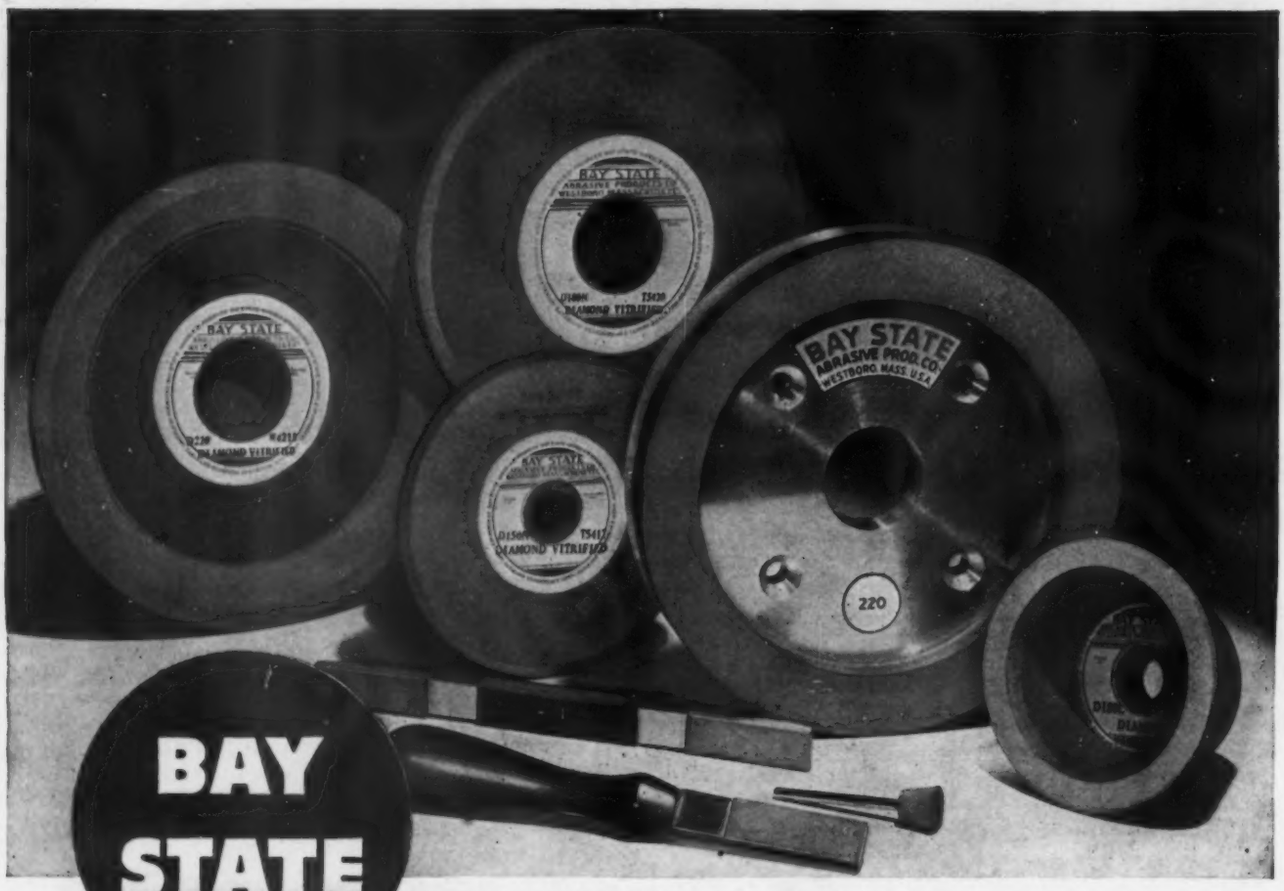
A new vitrified bond designed expressly for diamond abrasive makes a lusty new champion in the grinding of cemented carbide tools and other super-hard substances! The Bay State line of diamond abrasives (resinoid bonded, excellent for many precision and form-grinding operations; and metal bonded, best suited for off-hand grinding jobs) is now supplemented by a new *vitrified* bond.

Considerable research and experiment, together with thorough testing in actual use, have proved the superiority of this Bay State development. Now, the unparalleled abrasive power of diamonds gains the advantages of vitrified bonding — great strength and rigidity, plus faster, cooler cutting action. Results are long life, hair-fine accuracy and lower grinding cost per tool — important additions to the already high economy and efficiency of diamond abrasive grinding.

Typically, Bay State makes available to you this latest achievement, in a wide range of standard shapes and sizes . . . every one of them built to uphold Bay State's record of *top performance consistently duplicated.*

Write for Bulletin #1980, containing full information on Bay State Resinoid, Metal and Vitrified Bonded Diamond Abrasives.

BAY STATE ABRASIVE PRODUCTS CO.
1 Union Street, Westboro, Mass.



BAY STATE
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Top Performance Consistently Duplicated

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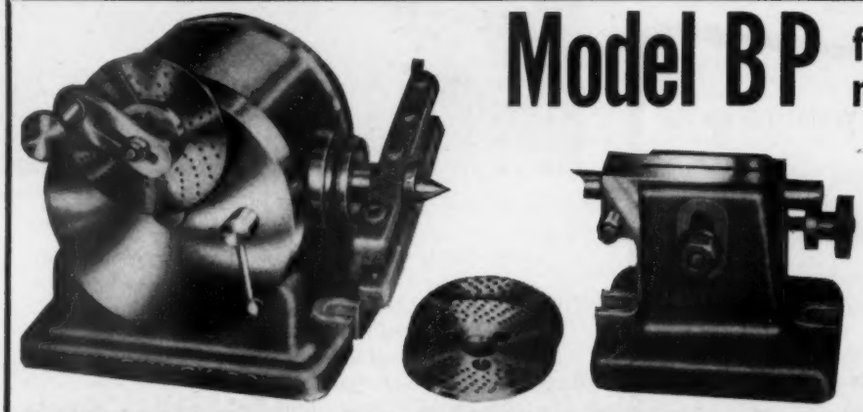
MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS · AND CYLINDERS

L-W Here they are — the popular Universal Dividing Heads



Model BP for plain milling machine

$128.55

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for complete indexing and spiral cutting

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HEADSTOCK—Ruggedly designed for maximum rigidity. Can be swiveled to any angle.

TAILSTOCK—Heavier, stronger design.

HEADSTOCK SPINDLE—Tapered bearings, bored for No. 10 B & S Taper. Increased diameter and length. Threaded nose, 2¼" diameter 10 thread USS.

WORM—Made from special alloy steel, accurately finished, end thrust taken by ball bearings. Easy, accurate adjustment of worm wheel.

WORM WHEEL—Large diameter, 40:1 ratio, accurately generated, securely mounted on spindle.

EQUIPMENT—⅝" table slot tongues, three index plates, dividing all numbers to 50, and even numbers to 100, with the exception of 96T. Index chart shows all divisions obtainable to 380.

When ordering AU Heads, specify either right or left hand model.

Surprisingly low priced, yet high in quality, L-W 11" Universal Dividing Heads offer utmost accuracy at a cost lower than any comparable equipment on the market. The unit is ruggedly constructed with many features which permit practical, profitable shop work.

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- how to select and heat treat the right tool steel for the job
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- the relation of design to heat treatment
- trouble shooting
- testing procedures

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By FRANK R. PALMER
Vice-President of
The Carpenter Steel Company
315 *Pages* 205 *Illustrations*
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Filled with practical information, by combining the steel maker's knowledge with tool making experience, TOOL STEEL SIMPLIFIED provides the answer to many of your toolroom problems. In easy-to-understand shop language, it explains the basic principles of good tool making so clearly and simply that it is the standard training book in hundreds of important plants. At the same time it offers the experienced man a valuable reference guide to check on every phase of tool and die making — steel selection, heat treating, furnace atmospheres, quenching, etc.

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Precision Marking Dies

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HIGH DUTY
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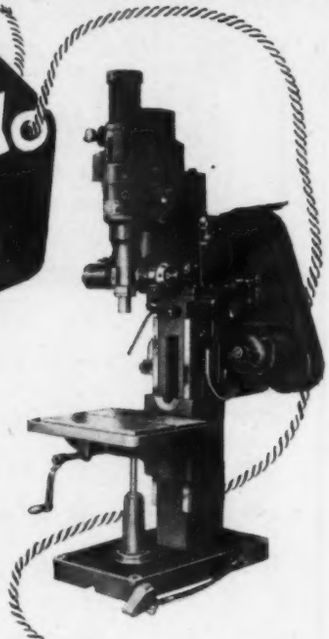

Kaufman No. 10A Hi-Duty single spindle. Lead Screw Tapper made in 3 HP and 1½ HP models, with ¾" N.C. and 1½" N.C. Threads in alloy steel offers these features: Fully enclosed . . . lead screw and nut operate constantly in oil bath . . . positively wear-proof clutches instantly engaged and controlled by air cylinder . . . quick traverse when not actually cutting threads . . . accurate depth control . . . control to protect tap overload, and further protected against jamming if work is placed in upside down . . . class 3 fits always assured and perfectly controllable.

Complete information upon request.

KAUFMAN MFG. CO.
MANITOWOC, WISCONSIN

HERE'S YOUR *low-cost* WAY TO TOOL UP FOR No. 0 TO 1" TAPPING

Ettco-Emrick TAPPING ATTACHMENTS

With these comparatively inexpensive Attachments for your drill presses, you are set to handle any tapping in the range of No. 0 to 1" taps at the highest practical tapping speeds, and with all the accuracy and sensitivity any tapping job requires. *. . . For full details about these Attachments, which have been in successful use throughout American industry for over 20 years, write today for BULLETIN No. 2.*

ATTACHMENTS
No. 100 No. 200

These two sizes have all parts operating in a pumped oil bath, assuring continuous smooth-running and sensitivity at high speeds so vital with small taps. Asbestos-carbon Cone Clutch—an Ettco-Emrick patented material—gives highly sensitive action and long wear.

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No. 1-B No. 2-B

An improved tapper, providing higher speed and longer life. Its leather cone clutch is unequalled for sensitive action and wearing properties. Clutch design includes provision for expansion and contraction. A long clutch life is common for these tappers.

ATTACHMENTS
No. 3-B No. 4 No. 5

The No. 3-B is designed specially for heavy tapping on light presses. It is geared so that the tap runs at one-third the speed of the drill press spindle. This has the effect of adding back gears to a small drill press. Nos. 4 and 5 are built around a floating amplified pressure multiple disc clutch and a shockless positive reversing clutch. All three sizes have the sensitivity of the smaller tappers.

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Honan-Crane "T" Type Clarifier, for direct-connection to machine tool equipment. Serves a single machine. (Other models serve two or more machines.)

...handle ONE to ONE HUNDRED

MACHINE TOOLS with Honan-Crane oil and coolant purifying equipment

Central installation of Honan-Crane Oil Purification Equipment supplying abrasive-free coolant to 112 grinding machines using 12 to 50 gallons per minute; volume, 3,000 gallons per minute.

Honan-Crane Mobile Coolant Filter, designed to work directly from machine tool sump. Serves any number of machines.

The effective removal of contamination and abrasives from oils and coolants has become a MUST in the successful operation of machine tool equipment.

Honan-Crane Corporation, a subsidiary of Houdaille-Hershey Corporation, can supply you with best engineering and equipment to solve your particular problem. Our Sales Engineers, backed by engineering and research, can furnish you with a system designed to meet your specific needs.

Many Honan-Crane installations have increased efficiency of machine tool operation by as much as 20% by . . .

- Cutting down rejects.
- Making temperature control of oils and coolants possible.
- Reducing cleaning and maintenance costs.
- Extending machine and tool life.
- Allowing continuous re-use of oils and coolants.

Write us today, listing types of equipment you operate. We will promptly analyze your problem and furnish you a plan for the purification of oils or coolants used in your machines.

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Subsidiary of

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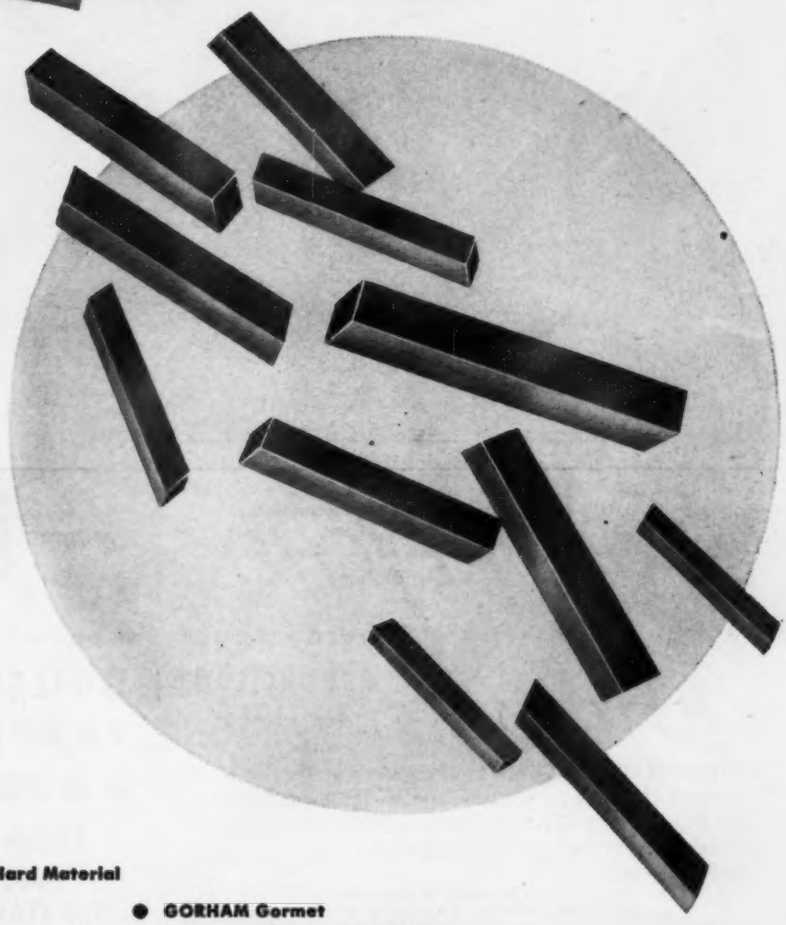
Gorham
HIGH SPEED STEEL TOOL BITS

QUALITY AND PERFORMANCE SPELL *Profits* FOR YOU



- **GORHAM Standard for the Commercial Field**
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Exceptional quality and outstanding performance have won nationwide recognition for GORHAM High Speed Steel Tool Bits. A reputation such as ours must be earned. We have consistently made and delivered a superior product. Through long experience in the selection and heat-treating of metals, we have produced a bit that meets the most exacting requirements of tough production jobs. That is why more and more applications are being found every day for GORHAM High Speed Steel Tool Bits. We can give immediate shipment on this well known, widely approved line . . . GORHAM! Catalog sent upon request.

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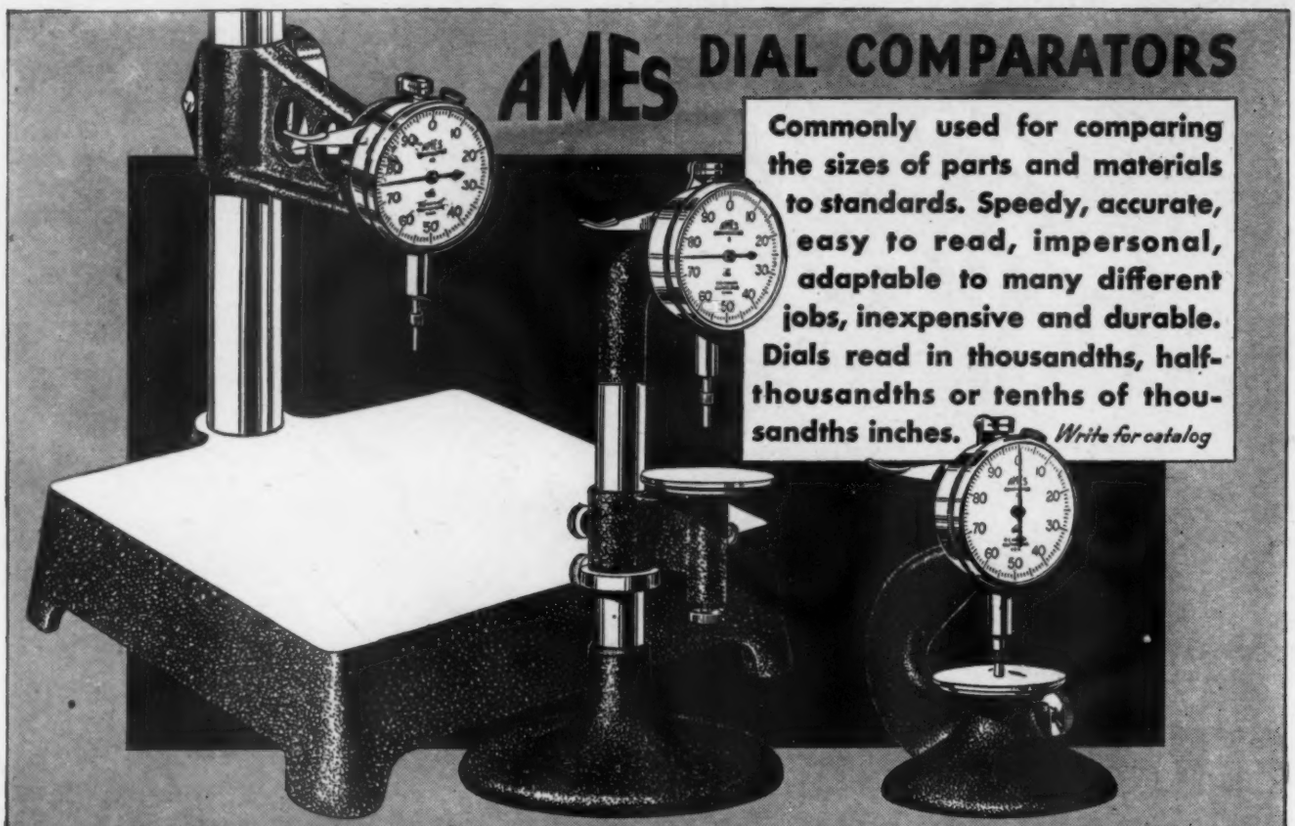

AMEs DIAL COMPARATORS

Commonly used for comparing the sizes of parts and materials to standards. Speedy, accurate, easy to read, impersonal, adaptable to many different jobs, inexpensive and durable. Dials read in thousandths, half-thousandths or tenths of thousandths inches. *Write for catalog*

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KEEPS YOUR PRODUCTION IN LINE!

CONTROL OF SURFACE QUALITY—Stepped-Up production... Increased Efficiency... Reduced Rejects - These are the results that can and ARE being realized EVERY DAY through the adoption of the Surf-Chek method of Designation and Quality Control.

• DESIGNATES MACHINE FINISH — Kit includes 60-page instructional text and molded plastic Surf-Chek Roughness Standard replicas of 20 surfaces, 5 to 500 microinches. Turning, grinding, milling, honing, lapping and polishing can now be definitely controlled. Thousands in use. For further data, address Dept. AM

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All Types of Fixed Center

DRILLING TAPPING & BORING HEADS

Four Spindle Head. All Spindles Adjustable for equally spaced holes.

FIVE TYPES, 56 SIZES, ADJUSTABLE DRILL HEADS
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IMPORTED SWISS FIVE RANGE

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30— 120 RPM	120— 480 RPM
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THE "ENGINEERED"

ADAPTER ASSEMBLY

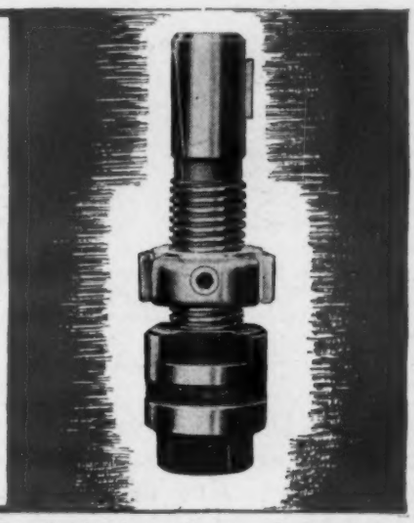
For the new Jacobs Production Chucks

With Customary Attention to Small but Important Details — Jacobs Again Produces an Outstanding Aid to Efficient Drilling Operations!

This modern development in design of Adjustable Adapter Assemblies for Jacobs Production Chucks provides a quick, convenient and sure means of compensating for variations in drill length. It interchanges with existing Morse Taper adjustable adapters and eliminates the need for Morse Taper Arbors. Jacobs Production Chucks screw directly into a threaded hole in the adapter.

An arc-shaped slot extending partly through the depth of the nut and opening into the bore of the nut locks the nut at any position on the adapter when set screw is tightened – similar to a brake-shoe on a railway car wheel. Cannot cause scoring or damage to threads. An exclusive feature with this Adapter!

Chuck screws directly into threaded hole of adapter to make a single, solid unit.



Made in three sizes, any one of which will, with seven Rubber-Flex Production Chucks, take care of all drill sizes from 1/16 to 9/16.

Available through your Industrial Supply Distributor. Write for Bulletin P-1 today. The Jacobs Manufacturing Company, Hartford 2, Conn.

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CRITERION *Boring* HEADS

ADAPTABLE

On Criterion Boring Heads shanks are interchangeable enabling operator to use head on different machines. Ideal for slide boring tool holder on small turret lathes. Smooth, compact, rigid. Lead Screw ground from solid AFTER hardening. Sold throughout the U.S. Order from your dealer. Request free literature.

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FOR QUICK CHANGE MARKING

- Fastest, simplest way to number parts.
- Easy—turn screw to change numbers.
- Made of best quality tool steel.
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A SET OF
NICHOLSON EXPANDING MANDRELS
fits all bores 1" to 7"

Set of 19 of these economy, precision tools does the work of 193 solid arbors. **Bulletin 1043.**

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GRINDING WHEEL DRESSER

Desmond Cutter *Desmond Hex Dresser*

We manufacture a complete line of Dressers and Cutters. Write for copy of catalog "A".

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NEW COOLANT FILTER SAVES MONEY 7 WAYS

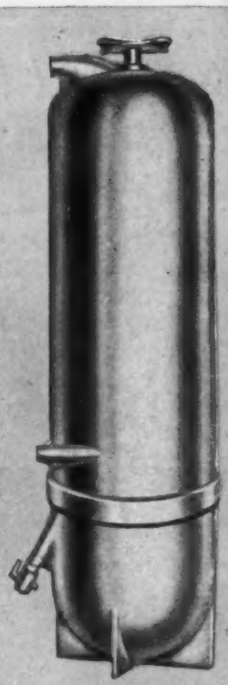
while protecting finishes

You save money first because Cuno's new COOLANT-KLEAN is *priced* lower than most filters. Fewer man-hours of maintenance are needed because the filter element stays clean longer—up to six weeks . . . helping to produce scratch-free finishes. When the element does need replacing, it's a quick job—under 5 minutes. You also save on the cost of elements because each one is priced less . . . and fewer replacements are needed. Grinder coolant stays clean much longer, so that saves money, too. And, seventh, wheel life is greatly extended, so you pay less for wheel replacements.

COOLANT-KLEAN handles full flow of coolant or cutting oil, removing all abrasive and metallic particles which would cause surface imperfections, yet it requires less floor space than other more expensive types. No filter aid needed. No pre-coating. No nuisance of "stuffed type" element. Applicable to individual machine or central system.

Describes "Finer Finishes at Less Cost"

This newest advance in coolant-cleaning is described in Bulletin 3110. Send coupon now for your copy. Find out how simple it now is to obtain finer finishes at less cost.



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ENGINEERED FILTRATION

CUNO ENGINEERING CORPORATION
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Gentlemen: Please send information on your new COOLANT-KLEAN filter for grinder coolants.

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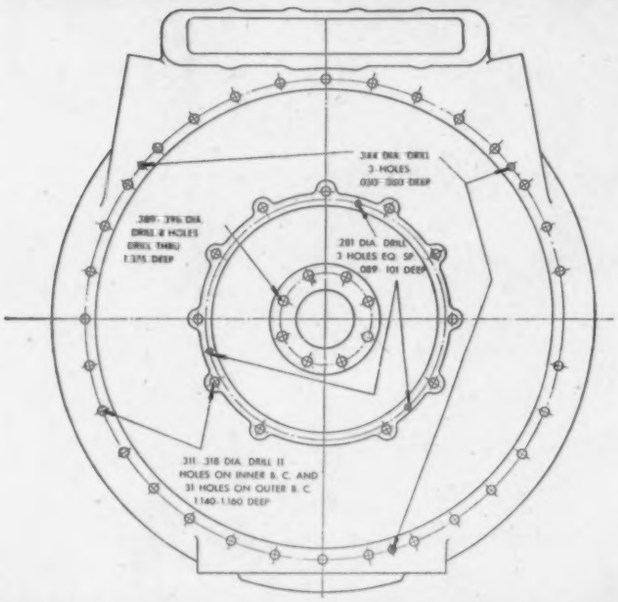
Please have representative call ☐

56 Holes Drilled in 8 Seconds...



Supercharger Rear Housing

56 holes as per layout . . . Magnesium 1408 feet per minute—1700 r. p. m.—.006" feed—10.2" penetration per minute.

Actual drilling time 8 seconds.

Loading and unloading time, either single hole or in multiples, dependent on jig design and human element factor.

HOEFER Multiple Drilling Heads Can Be Furnished for Most Needs

★ **Where holes can be worked in multiples for either drilling or allied operations Hoefer Multiple Spindle Heads offer a simplified method with time saving results.**

Hoefer Heads are attachable to your own drill presses or turret lathes—you save floor space as well as cost of new machinery.

The Hoefer Head featured here is but one of thousands we have developed for specific needs. Your requirements can be as easily developed by our engineers. Write telling us about your job.

Hoefer's Whole Business is Holes . . . . **HOEFER MFG. CO.** *Freeport, Ill.*

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(or for micrometric tests the "TUKON" Tester)

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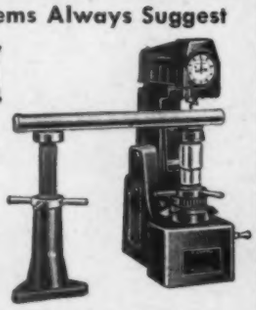

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HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

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Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

See our Advt. on page 280 Dec. 6, '45, American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
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YELLOW HEAD GRINDING WHEEL **DRESSERS**

Self-Lubricating

Faster Dressing without overheating

A Magazine for dry graphite
B Ducts to bearings
C Spindle bearings
D Safety Hood

For more than 20 years YELLOW HEAD "Self-Lubricating" Dressers have increased cutting speed of grinding wheels while decreasing dresser and cutter maintenance.

When using the YELLOW HEAD a thin film of graphite is sucked from the magazine handle, increasing wear and preventing overheating. Dry graphite guarantees free, greaseless lubrication. Economical, safe. Selection of cutting heads available. "Yellow Head" also co- es in plain type, one piece handle and head.

CITY MACHINE COMPANY, PIQUA, OHIO

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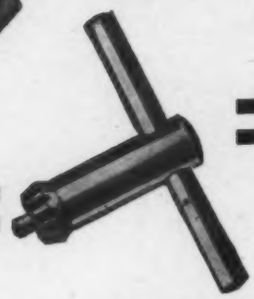
Almond Drill Chuck



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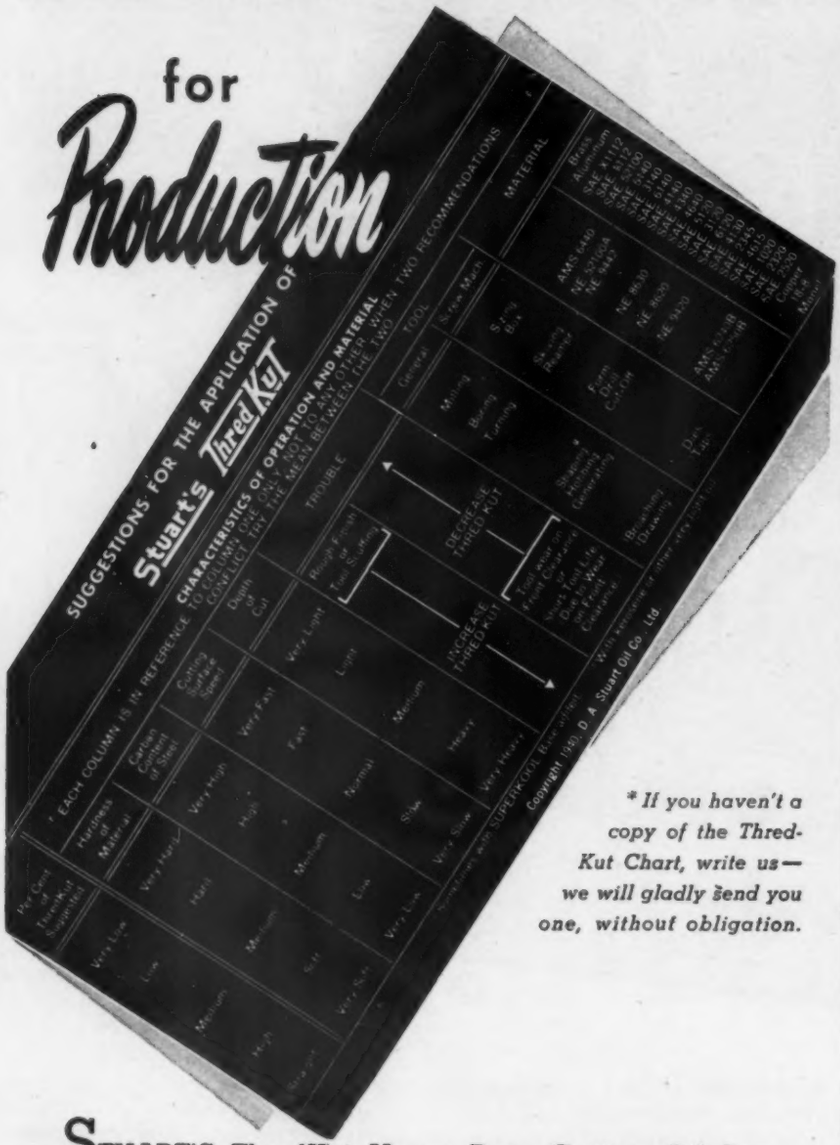

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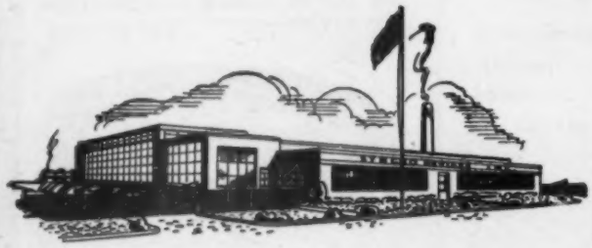

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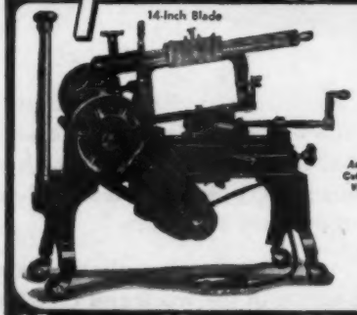

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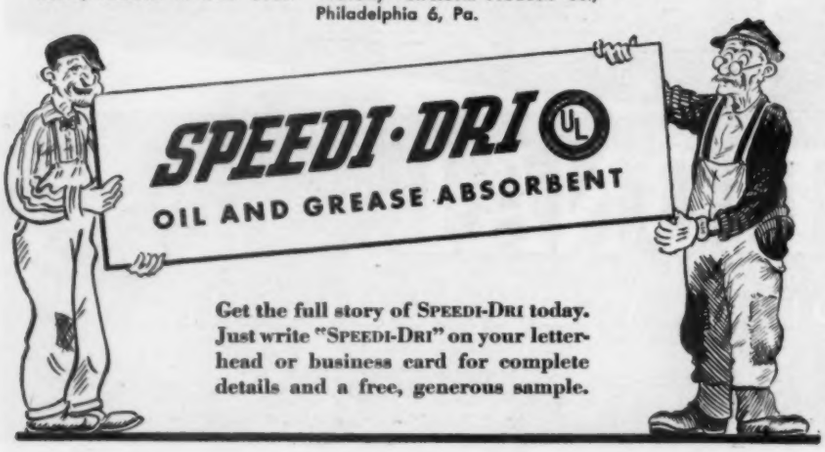

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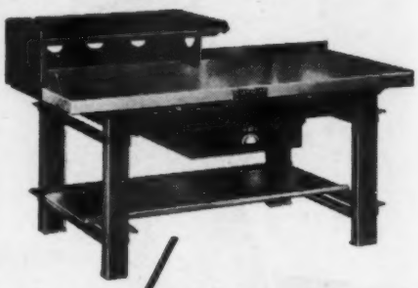

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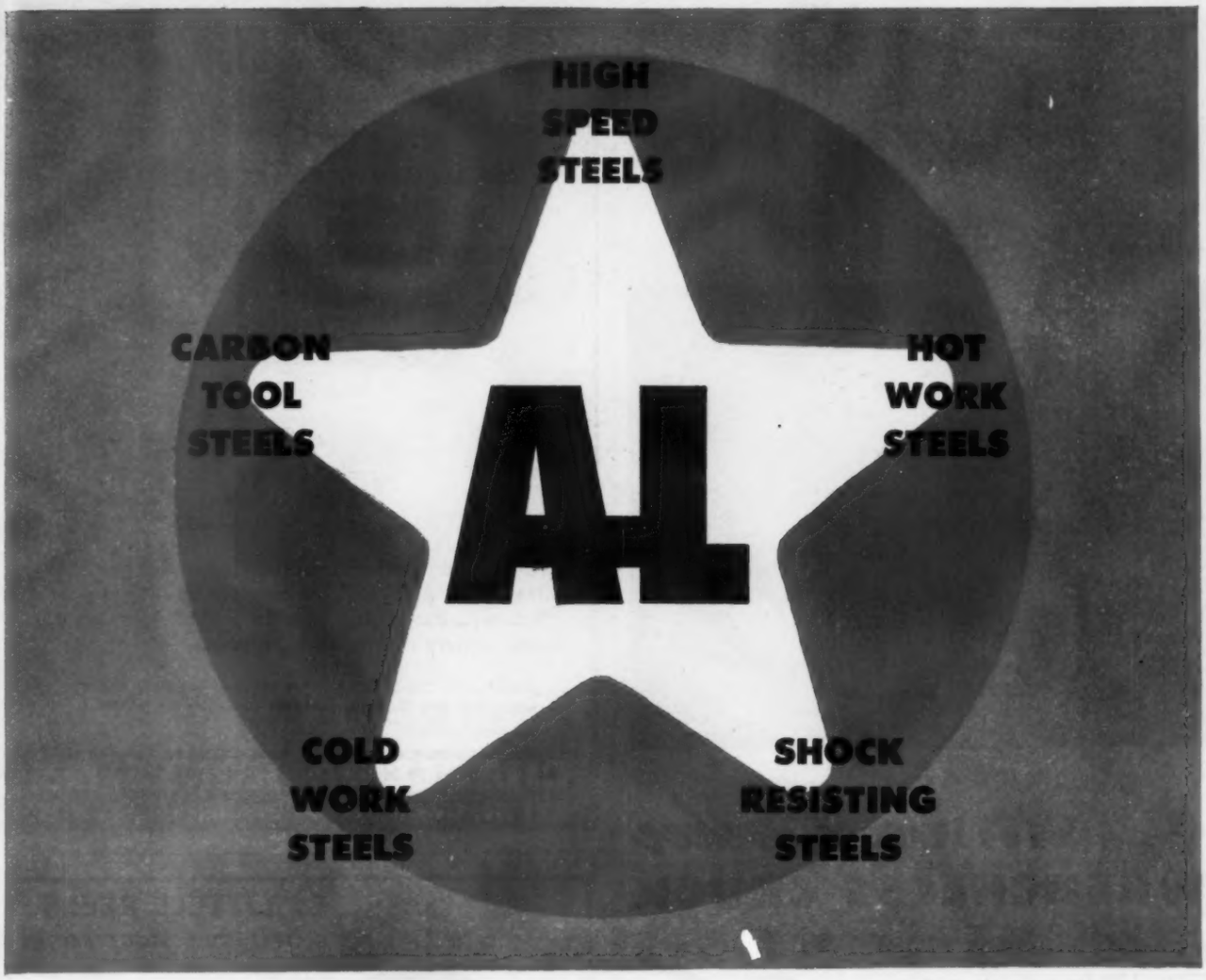

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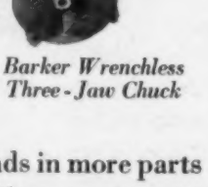

Barker Wrenchless Three-Jaw Chuck

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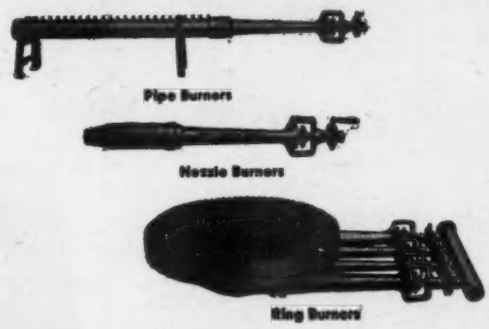

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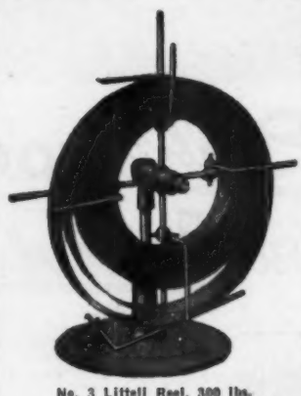

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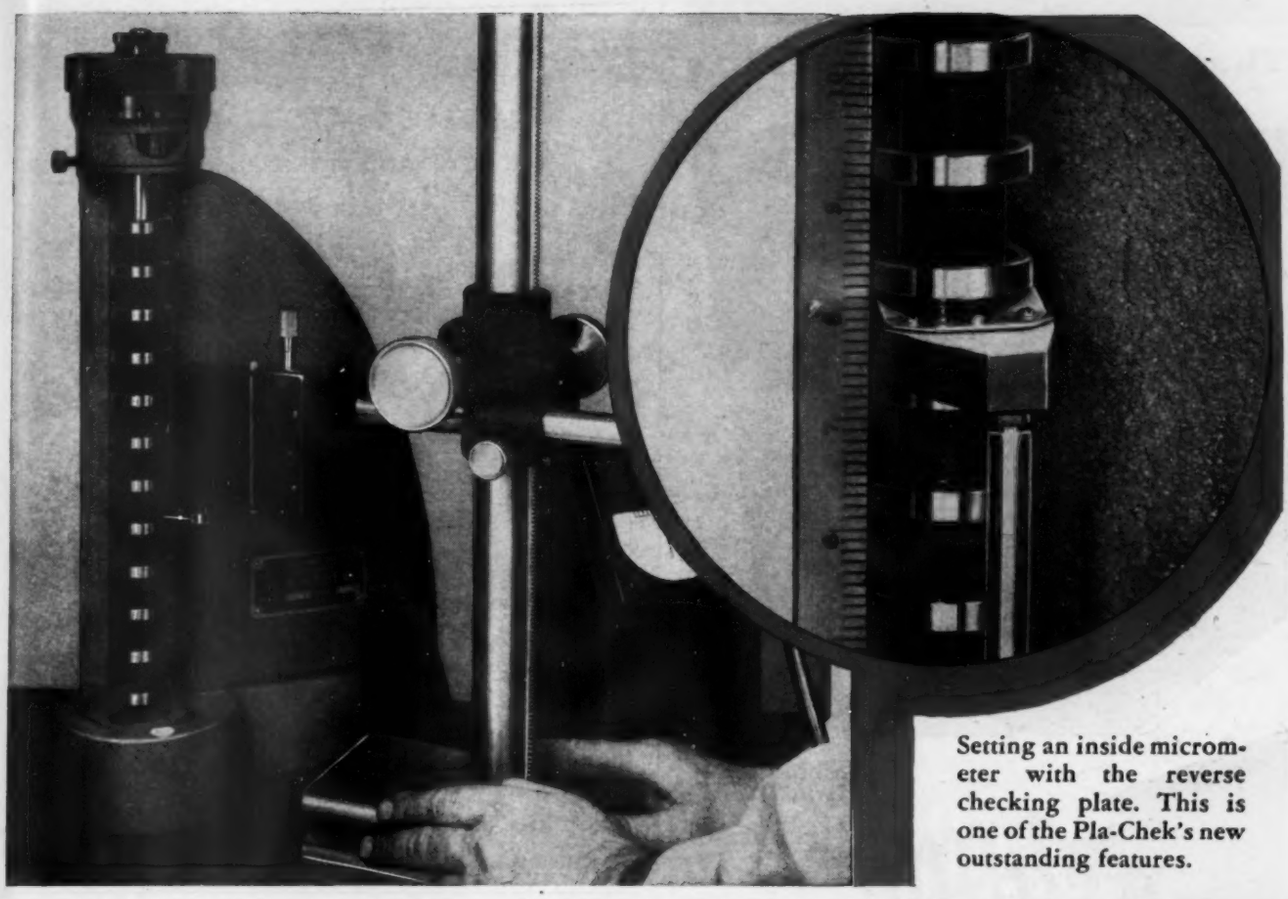

Setting an inside micrometer with the reverse checking plate. This is one of the Pla-Chek's new outstanding features.

NEW FEATURES, NEW DESIGN, NEW SPEED AND ACCURACY WITH THE NEW . . .

Now, Cadillac's new accessories greatly increase the usefulness of the Pla-Chek. A 3″ accurately lapped riser raises the Pla-Chek above the surface plate so that it can be placed anywhere on the surface plate. This feature makes it more convenient for checking parts over in the center of a large surface plate, as well as increasing the range of the gage to 15 inches. For checking dimensions under 3 inches from the plate, the Pla-Chek may be lifted off the riser and set directly on the plate, allowing measurements to be taken from zero to 12″.

Another new feature is the reverse checking plate shown in the insert. This is a horseshoe-shaped device with a spring, that can be quickly and easily clipped to any 1″ step on the Pla-Chek bar. The under surface is lapped flat, and wrings to the upper measuring surface of the measuring steps. This makes it easy to quickly and accurately set a height gage indicator for checking the under side of parts to be measured.

A hardened and lapped steel button in the 3″ riser plate, directly under the reverse checking plate, makes it possible to set inside calipers, inside micrometers or dial-type inside indicating gages.

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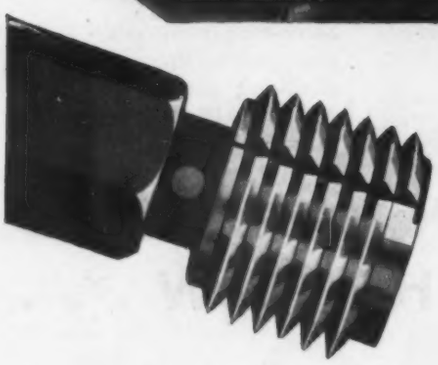

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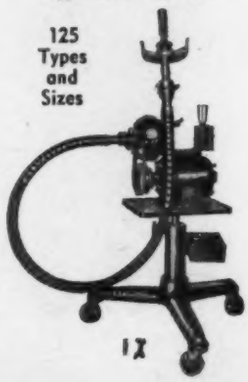

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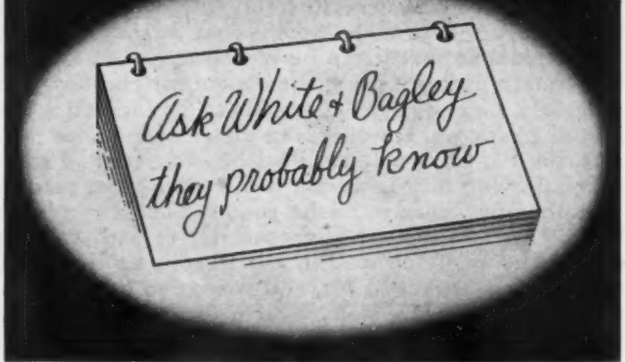

ECONOMY

Grinding and Cutting Oils and Lubricants for Every Metal-Working Purpose

THE WHITE & BAGLEY COMPANY

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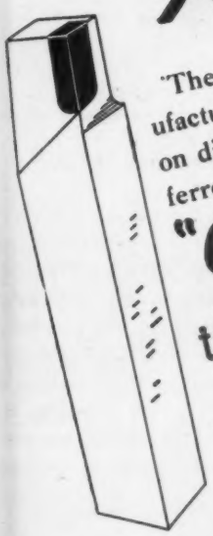
Talide
(TUNGSTEN CARBIDE)
Performance!

TALIDE METAL MEETS EVERY REQUIREMENT

"98% More Production per Tool Grind with Talide Tools"



"The chief engineer of a prominent manufacturer recently compared performance on different carbide cutting tools on a non-ferrous aircraft part. He reports . . .

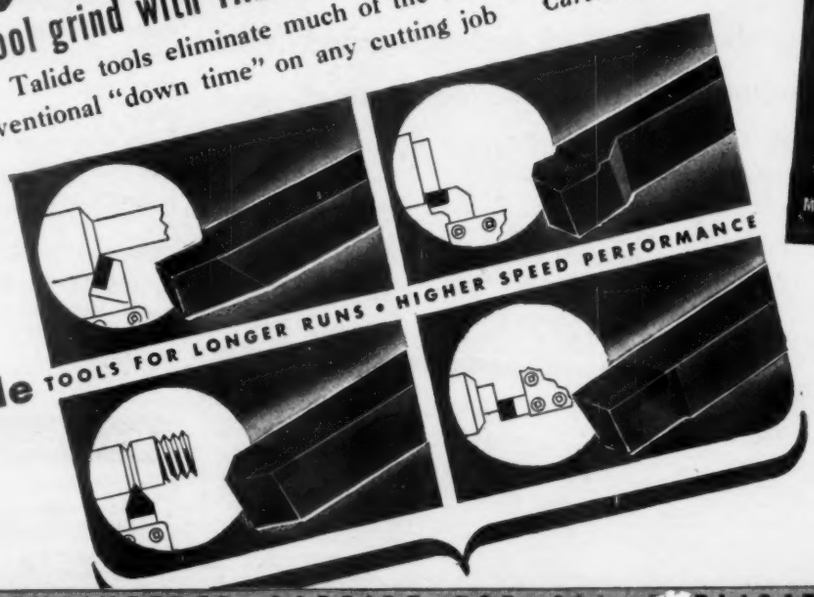
"98% More production per tool grind with TALIDE"

Talide tools eliminate much of the conventional "down time" on any cutting job —turning, boring, or facing. They keep cutting on and on and on.

Universally used for cutting operations on steel, cast iron and non-ferrous metals and non-metallic materials, Talide Tools are guaranteed to slice production costs.

You can obtain Talide tool tips direct from stock or a Talide sales engineer will call and recommend the proper use and grade of Talide Carbides for you.

Send for Catalog 44-T listing standard Talide Tools and Tips.



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METAL CARBIDES CORPORATION

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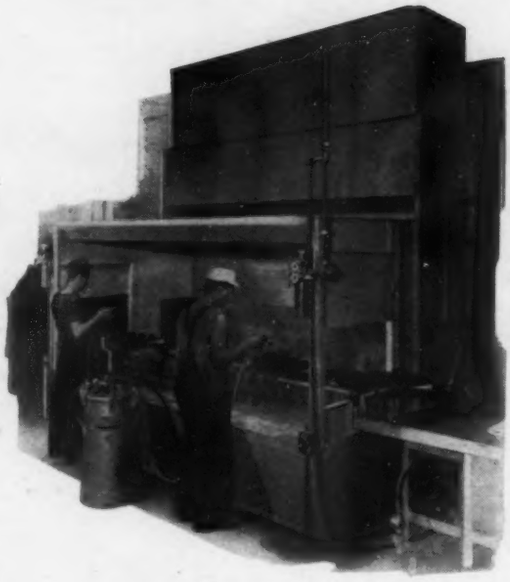
TRIAD *PR* Cuts Spray Booth Clean-Up Time



White, non-glare coating of Triad PR improves visibility in the booth.

Clean-up time is reduced from hours to minutes when Triad PR is used on the sidewalls of wet or dry paint spray booths. Readily applied with a brush or spray gun, PR is quickly removed by water or steam along with all accumulated surface deposits.

Detrex field representatives can also supply scientifically compounded water conditioners to fit your individual wet spray booth set-up. Case histories, compiled by our representatives, have shown that PR and associated Triad spray booth compounds have cut "down-time" and maintenance costs in every installation in which they have been used.

DETREX CORPORATION
Detroit 27, Michigan

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10. REMARKS: In removing Triad PR, two maintenance men spent 20 minutes cleaning a 125-foot canopy and two large spray booths and, in addition, prepared another batch of PR for respraying the cleaned areas. Formerly, when the company's own compound was used, it required one hour for five men to clean the canopy alone.

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(AWS Classification E6020)

"I use it for conventional fillet, deep fillet, and deep groove welding. It's a honey for all three jobs.

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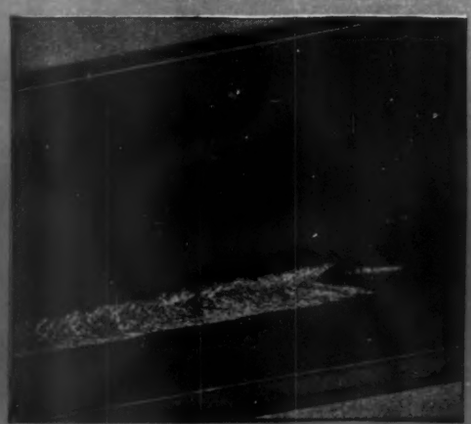

"Slag covers well and comes off easily. Airco No. 315 can be used with AC and with DC, straight or reverse polarity. You can use it for any job that calls for a 6020 or 6030 electrode."

This new electrode is a notable addition to the famous line of Airco electrodes. Whatever your welding need, there's a quality-proved Airco electrode for every requirement. Catalog No. 120 describes the complete line.. Write for a free copy to your local Airco office, or to Dept. AM. Address Air Reduction, General Offices: 60 East 42d St., New York 17, N.Y. In Texas, Magnolia Airco Gas Products Company, General Offices: Houston 1, Texas.

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Represented Internationally by Airco Export Corporation

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AIRCO ELECTRODES FOR BETTER WELDS AND EASIER WELDING

You Could
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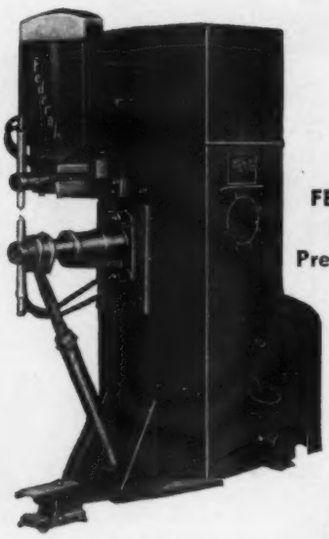

FEDERAL PH-1
HYDRAULIC
Press Type Welder

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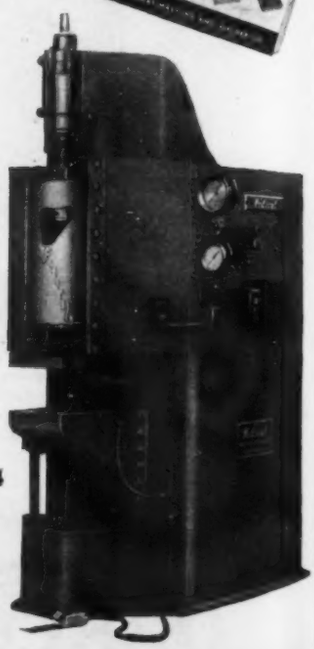

FEDERAL PH-4
HYDRAULIC
Press Type
Welder

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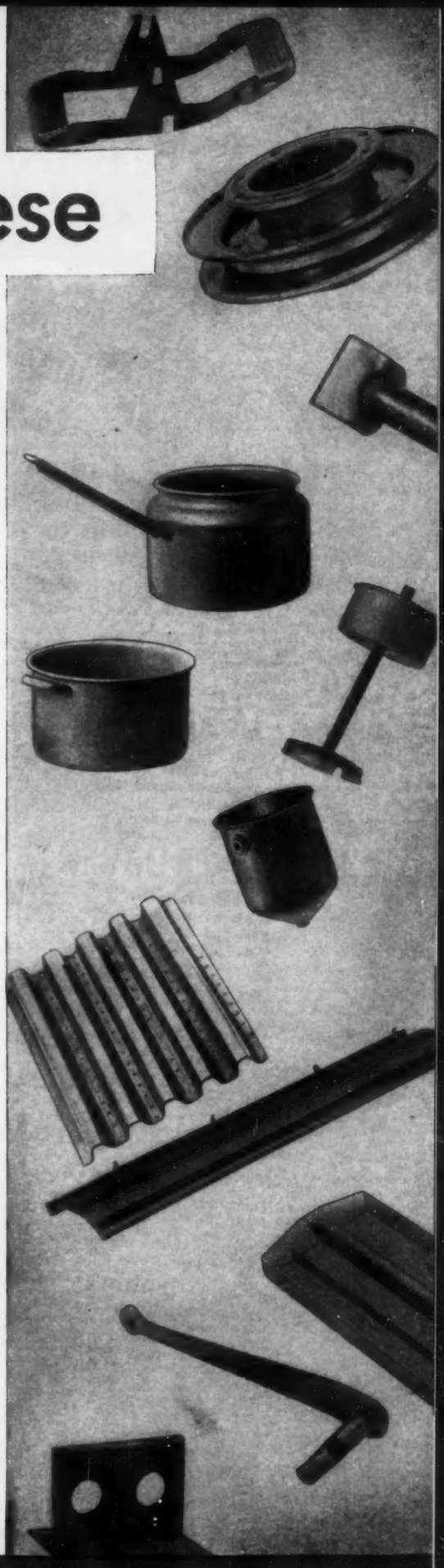
MACHIN A

Never List ALL

...on Possible On These

...Press-Type Welders



It is no exaggeration to say that the versatility of Federal Press-Type automatic Resistance Welders can never be fully described.

Reason is that *new* corner-cutting, cost-saving applications are being developed every day in the year. What it boils down to is that if you have any metal fabrication in production quantities involving the permanent fastening of metal, it is important from the standpoint of quality, quantity and cost, that you apply to its production design all of the saving and speeding this type of welding can afford. Whether it be joining of delicate parts, such as in the radio tube illustrated at upper left, or heavy parts involving half-inch steel, like the bell-crank at lower right, or one of a million things in between, Federal Engineers can show you quickly and clearly how the Federal method fits your production.

Shown at left are the smallest (PH-1) and the largest (PH-4) standard models of the Federal Hydraulic Press Type Welders. PH-1 machines rate from 30 KVA to 75 KVA . . . PH-4's are standard up to 600 KVA. There are many sizes in between, many types to choose from . . . Air Operated, Motor Operated or combinations of Air and Toggle mechanism. They are adaptable to projection, spot or "percussion" welding or resistance brazing.

Write today for a Federal Press Type Welder Bulletin or arrange for a consultation on your own designs with a Federal engineer.

IN RESISTANCE WELDING THE NAME OF AUTHORITY IS

Federal

...AND WELDER COMPANY

230 DANA STREET
WARREN, OHIO

9 out of 10 are Automatic

HERE ARE A FEW OF THE MANY USERS!

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MANY HAVE FOUND TRANSPORTERS

SAVES THE MAN...LIGHTENS HIS LOAD...TAKES THE WORK OUT OF A JOB

CONTROLS IN STEERING HANDLE

All movement of the Transporter is controlled by gentle touch of the hand and thumb. Operator simply rests his palm on the cross handle, applies easy thumb pressure to the button, and away goes a 6000-pound load at creeping or walking speed, forward or reverse. Simple as turning the ignition in a car, effortless as a pleasant walk.

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Again, operator has complete control of stopping as well as starting with absolutely no manual effort. The thumb is released, power automatically shut off, and Transporter comes to a gradual stop. Guide handle to vertical position and heaviest loads come to an instant stop. Everything is completely mechanical . . . nothing left to human error.

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Day-dreaming, inattention or sudden distraction from work cannot endanger the operator or the load with Transporter "Dead-Man" Control. When the hand is taken off the steering handle, it flips back to its normal position, and the Transporter stops dead. It becomes inoperative *immediately.*

SHOCKLESS HYDRAULIC LIFT WITH EASY FOOT CONTROL

Simple foot pressure on almost ground level lever raises load to position for horizontal movement. No standing on lever, no straining of leg muscles. The load goes up gently, safely, evenly. Same easy foot pressure lowers load at any speed, without shock, without jar, without danger to the most fragile load.

● Today thousands and thousands of Automatic Transporters are in use the country over. As you can see from the partial list of users shown above, daily they haul anything and everything for every kind of business...have been doing so for years. Truly a miracle electric truck, it is the only one that is completely industry tested . . . the only one that has withstood the test of time.

It has built-in features that save the man . . . that end back-breaking human toil. It saves so much, that many have amortized its cost in four months or less. Let us show you how it happily combines advantages for both management and labor . . . how much it lightens life's loads. Mail the coupon for complete facts.

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IS USING THEM!

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CUT HANDLING COSTS IN HALF!

FRONT WHEEL POWER DRIVE

This feature permits the Transporter "to turn on a dime." It gives complete freedom in maneuvering sharp corners and making turns in narrow aisles. It will turn a full 210 degrees with constant power. Only Transporter has this Front Wheel Power Drive. Back Wheel Power Drive Trucks can't begin to provide such time and energy-saving "turnability."

LOWEST OPERATING COST

The Transporter is the only material handling electric truck that provides maximum power for a full day's hauling and yet uses *only* an ordinary light socket for 5 hour recharging. Current cost is 10c to 11c a day based on an electric current cost of 2c a kilowatt hour. Again, no other electric truck can approach such economy in battery, charger and current cost.

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Lightens LIFE'S LOADS

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Div. of the Yale & Towne Mfg. Co.
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Please send me complete information about Transporter, the miracle electric truck, and how it can cut my material handling costs in half.

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Keep production on its toes by standardizing on . . . .

VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels.

. . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

Vitrified Wheels

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WESTFIELD CONN.

Add this dependable protection to your safety program . . .

ENCLOSURE SAFGUARD . . . SWEEP SAFGUARD

For all types and sizes of punch presses

Made for blanking, piercing, notching, cut-offs, chute, and automatic feeds. Adjustable to all sizes of dies. Gates can be tilted inward close to die. Staples may be moved up or down to straddle any obstruction. Easily attached to the press. Transparent shields furnished for the front or sides of guard.

Operator is protected as sweep arm clears the danger zone thru slight downward movement of the ram. Shield prevents operator from working back of the guard. Easily installed to operate right or left handed. Sweep arm adjustable for clearance of die or bolster.

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SAFETY ENGINEERS
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TORNADO VACUUM CLEANER

BEFORE dust and dirt damage valuable motors and machinery, clean up floors, walls, ceilings and overhead beams and pipes with TORNADO. Powerful suction insures quick cleanup. 1 h.p. G. E. motor, 49" waterlift, 175 c.f.m. Attachments for cleaning everything.

Request details and FREE TRIAL Offer

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12 characters, more or less, stamped at one blow. Press the thumb clip and quickly change type or dies for next markings. No weakening groove in type. Heavy Duty Type with "Extra Strength Shoulder" stamps any untempered steel, or other material. Ask for HERCULES HOLDER & TYPE.

Write for literature and price lists.

THE ACROMARK CO.
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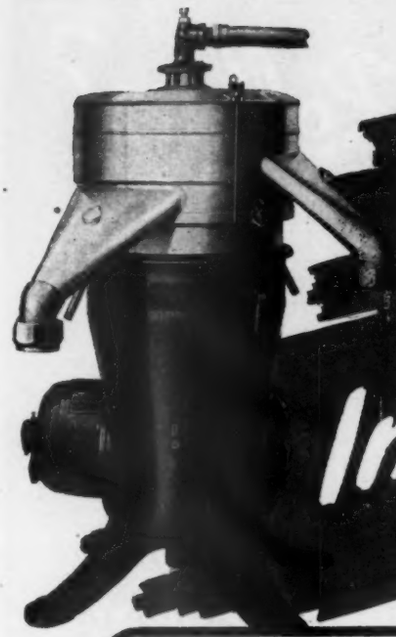

WHERE CLEAN, DRY OIL IS ESSENTIAL... Install a DE LAVAL

ALMOST every metal-working plant has one or more operations where an adequate supply of clean dry oil is a virtual necessity. The list at the left suggests just a few of them.

Where ***clean*** oil is the prime requisite, De Laval Oil Purifiers remove foreign impurities such as dirt, abrasive or metallic particles and restore the oil to "like-new" purity. Because of the greater intensity of centrifugal force, De Laval machines are more thorough than other means.

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And where ***speed*** of purification is the chief factor, De Lavals answer the need especially well, for they discharge clean dry oil ***continuously***. They eliminate maintenance slow-ups.

Write for Bulletin MM-1, indicating which application you are chiefly interested in.

A Few Applications for* DE LAVAL *Oil Purifiers in Metal-Working Plants

BALER OIL
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FOR GREATER OPERATING EFFICIENCY

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780 THREADS an hour

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Material: Dural 17 ST

Rolled by Precision Dies

Developed to a high degree of controlled accuracy, modern thread rolling now gives you both QUALITY and QUANTITY.

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Tubular MICROMETER

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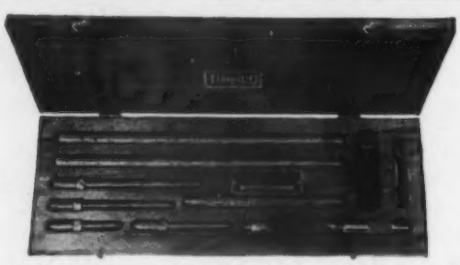

INSIDE MICROMETER SETS TU-MI-CO TUBULAR Construction—strong, light, easy to assemble and handle. All tips and connecting surfaces are hardened and lapped for long, trouble-free service. Sets complete with mandrels, wrenches, instructions—in strong wood cases.

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The full line of JKS Secomet diamond wheels consists of resinoid, metal and vitrified bonded types. In order to produce perfect finishes on carbide tipped tools and other required metal surfaces, diamond powder is evenly graded by a unique JKS scientific process and uniformly distributed throughout the bonds. Select your wheels from Price List No. 45.

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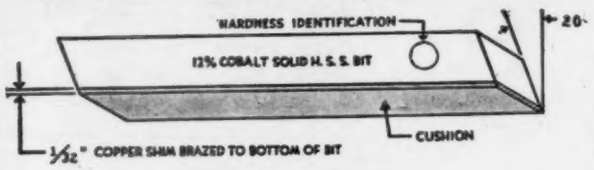
Now-for the first time-a real

GENERAL PURPOSE

tool using the HIGHEST COBALT HIGH SPEED *Steel*



65-68 Rockwell "C" Hard

PRICE LIST Cushioned Solid 12% Cobalt H.S.S. Tool Bits					
Size of Bit			In Lots of		
			1-9	10-49	50+
1/4	1/4	2 1/2	$ .60	$ .55	$ .50
5/16	5/16	2 1/2	.80	.75	.70
3/8	3/8	3	1.05	1.00	.95
7/16	7/16	3 1/2	1.45	1.40	1.35
1/2	1/2	4	2.00	1.95	1.90
5/8	5/8	4 1/2	3.10	3.05	3.00
3/4	3/4	5	4.60	4.50	4.40
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The "cushion" does it—you get the extreme Rockwell and RED HARDNESS of 12% Cobalt H.S.S., plus an EFFECTIVE TOUGHNESS heretofore unobtainable with High Speed Steel Tools.

Gives production increases of from 20% to 200% through increases in speed and feed.

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We know this is difficult to believe, but a trial will convince you—and you are the one to be satisfied.

Guarantee: If not satisfied that this is the BEST GENERAL H.S.S. TOOL you have ever used . . . bits can be returned for FULL CREDIT.

Write for complete circular.

See these tools on display at the
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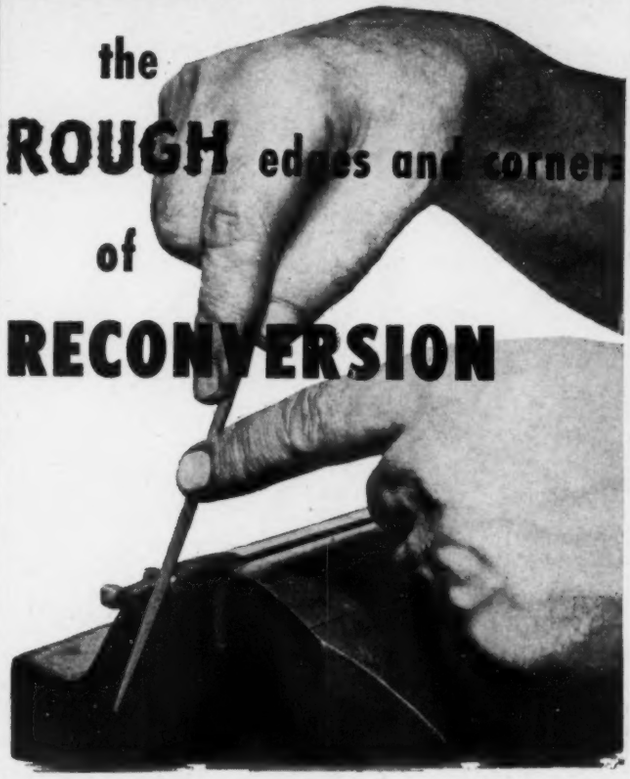
Phone ORANGE 5-2500

HELPING TO SMOOTH

the **ROUGH** edges and corners of **RECONVERSION**



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These precision tools . . . made by Swiss pattern file specialists with forty-five years of experience . . . are outstandingly uniform in hardness throughout their entire length, are accurately cut, have more filing surface than ordinary files, and are made in only ONE quality . . . the best. Users report that they save 25% and more in filing costs because of their longer life and faster work, besides providing better results.

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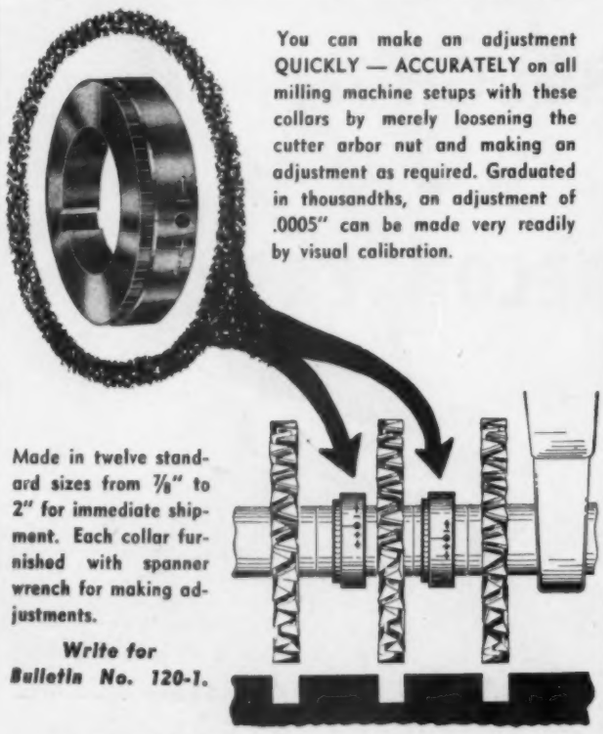
MICROMETER ADJUSTMENT

on side milling cutters and gang milling setups with Dayton Rogers Micrometer Adjustable Spacing Collars



You can make an adjustment QUICKLY — ACCURATELY on all milling machine setups with these collars by merely loosening the cutter arbor nut and making an adjustment as required. Graduated in thousandths, an adjustment of .0005" can be made very readily by visual calibration.

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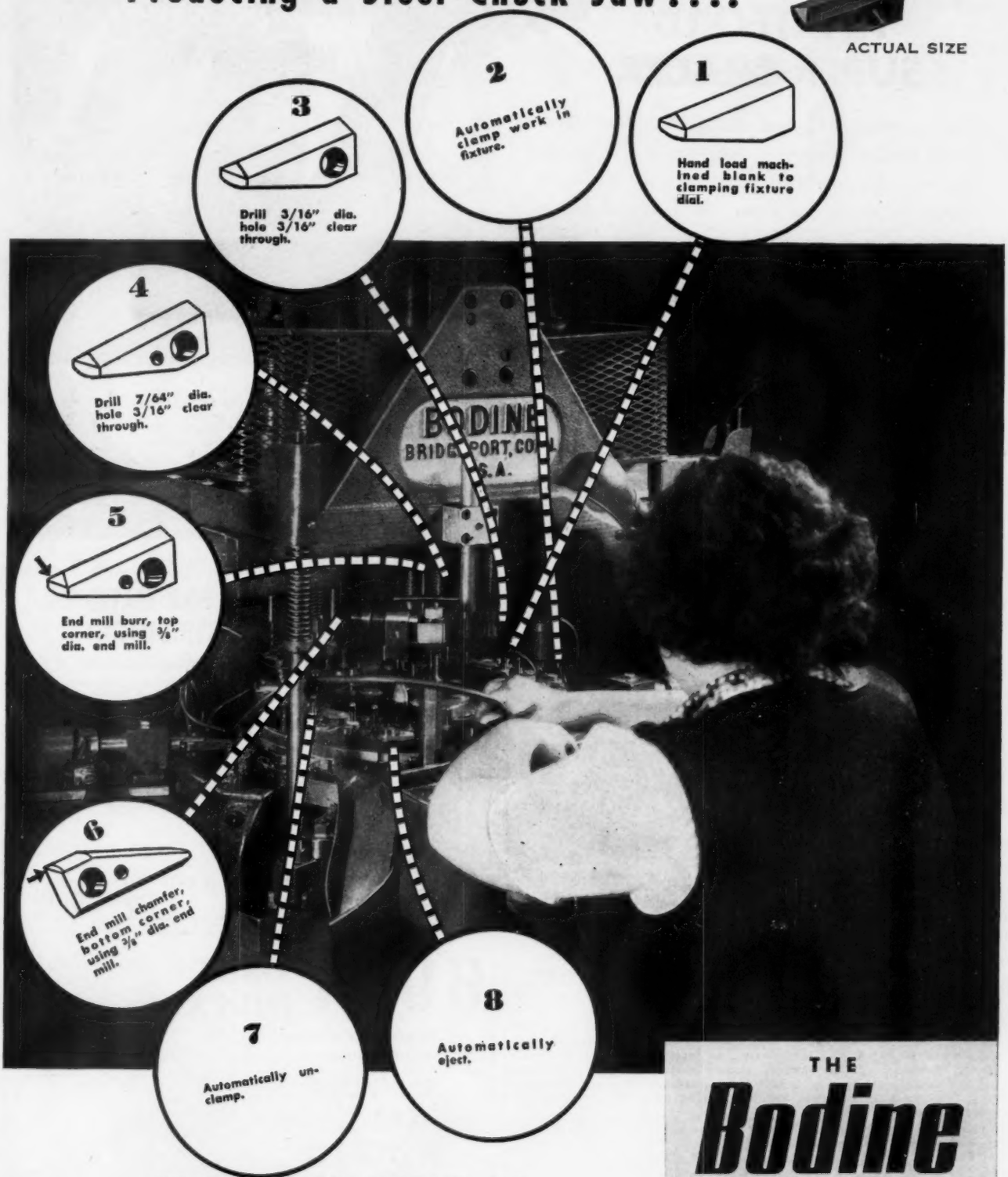
Enclosed is $..... (in stamps, check, money order).
Name .....
Title .....
Company .....
Address .....

AMERICAN MACHINIST · 330 W 42nd St., New York 18, N. Y.

Bodine...Case History No. 15

Producing a Steel Chuck Jaw....

ACTUAL SIZE



This Bodine automatic Multi-spindle, horizontal dial machine is producing 550 pieces per 50 min. hour at one piece per stroke of the machine at the Jacobs Mfg. Co., Hartford, Conn. It can do a similar job for you.

THE
Bodine
CORPORATION
BRIDGEPORT 5, CONNECTICUT

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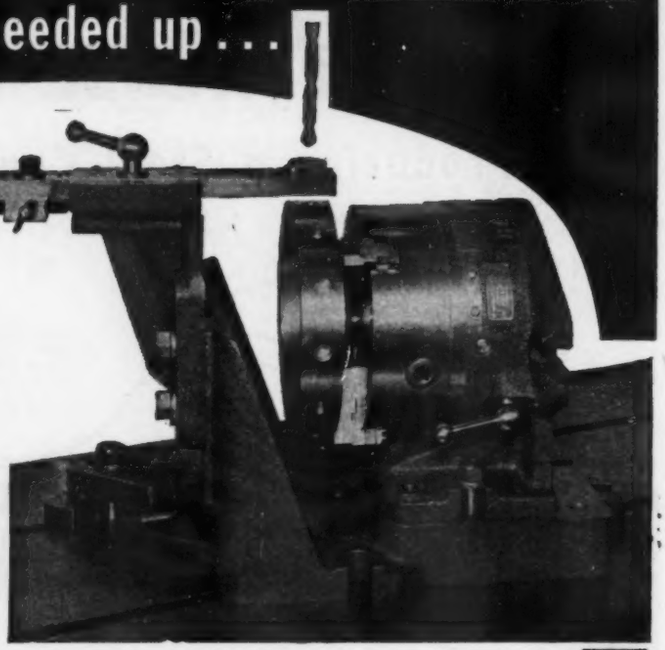
Radial Drilling can be speeded up . . .

with the

HARTFORD SUPER-SPACER

When applied to radial drilling, the HARTFORD SUPER-SPACER provides a fast, accurate means of indexing. All possibilities of error are eliminated through the use of mask plates. Set-up time is reduced—variations in length and diameter are conveniently handled—ample adjustment is provided for any and all jobs that come within the range of the attachment. This application of the Super-Spacer is but one of many. Other uses include plain drilling, milling, planing, shaping, slotting and jig boring. In all cases the HARTFORD SUPER-SPACER has proved a practical way to speed up production.



The Radial Drilling Attachment is easily secured to the base of any standard HARTFORD SUPER-SPACER and greatly extends the utility of this device. Write for illustrated booklet showing a few of the many applications of this modern indexing device.

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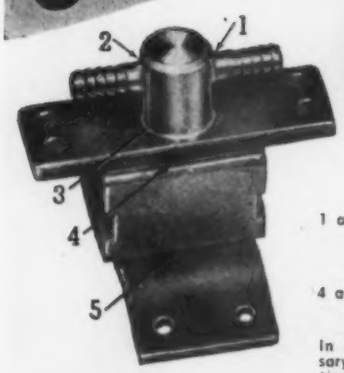
3 BRAZING OPERATIONS

PRODUCED THIS *Complicated* ASSEMBLY



1 and 2 Two brass tubes to steel by torch brazing

3 Shows brazing of steel to steel by copper in furnace

4 and 5 Two brazed joints of steel to brass by silver solder in furnace

In producing this part it was necessary to meet army and navy specifications as to location of parts and strength of braze.

HYNDMAN BRAZING SERVICE for fabricating and joining metal assemblies and metal parts of every kind is now available to product designers and engineers for pilot runs. This is to give you an opportunity to prove the many benefits of brazing such as improving product quality—increasing production speed—reducing products costs. It affords manufacturers tooled up and ready to go into immediate production a definite method for solving manufacturing and assembling problems.

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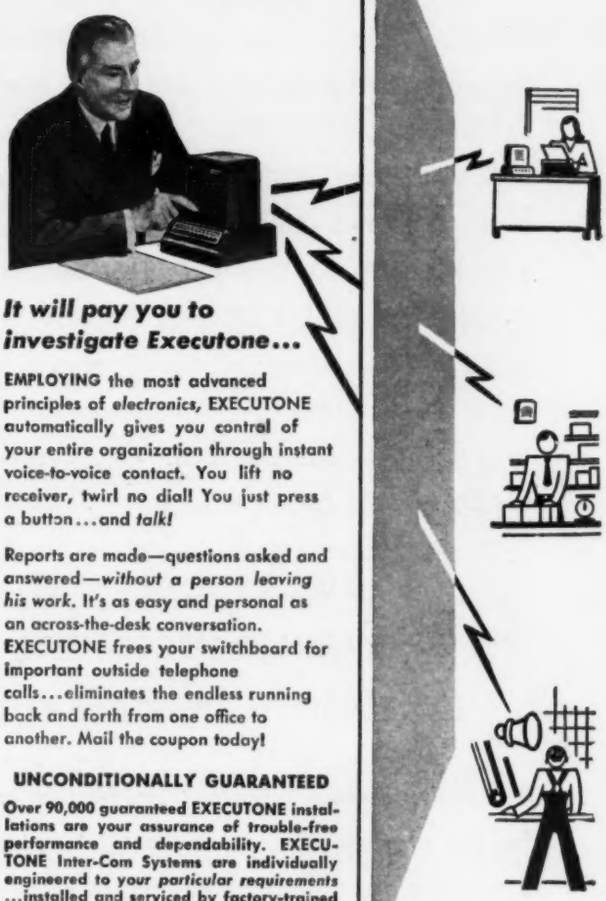

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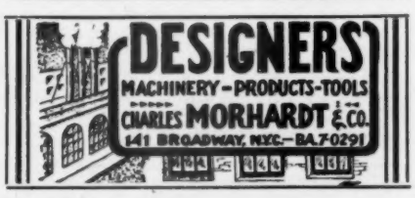

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Additional Contract Work Ad on page 340

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1. **Works Manager**
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The company is long established and is well and favorably known in its industry. The plant is located in a fine residential section of New York State. All three men must be high caliber, over thirty years of age with at least ten years' experience in manufacturing, preferably metal working.

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P-581, American Machinist
330 W. 42nd St., New York 18, N. Y.

WANTED—MACHINE DESIGNER

Experienced on special or paper working machinery. Excellent opportunity for permanent position. Location Philadelphia area. Please give complete details, age, experience, etc.

P-500, AMERICAN MACHINIST
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WANTED

Foreman for small Machine Shop located in Northwestern Pennsylvania. Must have had Machine Tool experience. Write giving age, experience, starting salary expected and when available.

P-527, AMERICAN MACHINIST
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WANTED
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P-523, AMERICAN MACHINIST
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WANTED
A CHIEF ENGINEER

We want a chief engineer to direct department in product design, application and uses of construction machinery—Chicago. Experience necessary as head of department or assistant in product design of heavy machinery. M.E. degree or equivalent. Age 35-50. Write experience in confidence.

P-589, AMERICAN MACHINIST
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WANTED: ASSISTANT Shop Superintendent with practical machine shop experience as a machine operator, knowledge of shop mathematics, layout and setup work. Requires knowledge of modern shop control, routing, operating methods, also methods of cutting metals and the supervision and direction of men. Location: Fox River Valley, Wisconsin. P-530, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

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(Continued on page 340)

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For small tools such as die heads, etc. Good opportunity for high grade man. Give full particulars as to experience and salary desired. Application will be treated as strictly confidential.

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1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete.
2—#55 National Acme 1⅝" 4-spindle Automatics, complete.
1—#2G Brown & Sharpe Automatic.
1—#1 Brown & Sharpe Automatic, old style.

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100" Niles-Bement-Pond Bor. & Turn. Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
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Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Woodward & Rogers, 6 spindle, #2 M.T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
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3' 9" column Cincinnati-Bickford.
3' 9" col. American, S.P.D.
3' Dreses, 10" col. QCG., M.D.
3' 10" Col. Fosdick
5" Arm 13" Rd. Col. Cinn. Bick, air clamp.

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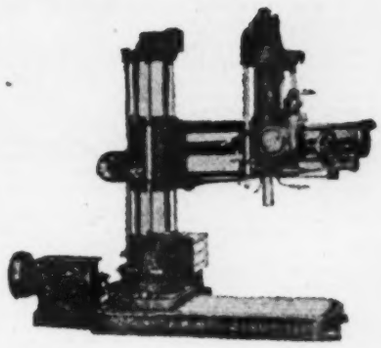
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
#4 Brown & Sharpe Universal Grinder.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole, 4" dee.
Oliver Model 51 Drill Grinder; 1½" cap.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
#11 Brown & Sharpe Plain Cylindrical.

Blanchard Grinder #16, 30" dia. magnetic Chuck, 25 HP 3-60-440 V. Motor.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14"x36" with 10"x36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter



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14x6 Hendey Toolroom Lathe, G. H., M.D.
14x8 LeBlond Toolroom Lathe, cone drive.
14"x6' Hendey 12-speed geared head
14"x102" centers Hendey Lathe, M.D.
16"x6' Rockford Tool Room Lathe, taper, collets.
16x8 American, Taper Attach., Motor Drive
27"x18' Lodge & Shipley 12 speed, geared head 12' centers.

MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
No. 0 Bickett Vertical Bench Miller.
#1-#1½-#2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Hall Planetary Thread Miller 24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#2½, #3 LeBlond Universal.

PLANERS

30"x30"x10' Cinn. Heavy Pattern, 2 Hds.
20"x20"x24" N.-B.-P., Planer Shaper, M.D.
24"x24"x6' Cincinnati, 2 heads, M.D.

POWER PRESS HEADQUARTERS

#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed 24" x 36", 4-post.
3—25 ton K. R. Wilson Hydraulic Presses.
Beck Duplex Embossing Press.
75 ton H.P.M. 2 post, Hydraulic Press.
#1 Bliss Straight Side, double action, Cam Press. Will draw and lift out 2¾".

SHAPERS AND GEAR CUTTERS

12" Schuchart & Schutte Gear Hobber.
#1 Adams Gear Hobbers, Belt driven (3).
16" Gould and Eberhardt
21" Smith & Mills B.G. Helical Gears.

SHEARS & METAL CUTTING MACHINERY

Lennox Splitting Shear, ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Gould & Eberhardt Slitting Shear, 10 ga.
Bertsch 3"x36" Geared Slip Roll Former.
Niagara 48" Roller Leveller, 6 Rolls.

MISCELLANEOUS

Waterbury-Farrel Cold Header, double stroke, open dia, ½" cap. & 6".
Manville Cold Header, single stroke, solid die, 3/16" cap.

Lacquer Heater Tank with acquistat. 150 ga.
Heat Treating Furnaces for the tool room.
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#5A High Speed Riveting Hammer.

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POSITIONS WANTED

(Continued from page 338)

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WELDING ENGINEER: Resistance welding and brazing specialist, also experienced in fusion welding. 12 years with a leading manufacturer and user of all types of welding. Experienced in all phases of metalworking industry. Desires engineering or laboratory work in resistance welding or brazing with manufacturer in N. J. area, 35, M.E., Married, salary $6,000. PW-590, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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SALES EXECUTIVE: Metals and metal products. Eleven years present position, managing and developing sales, and directing advertising of metal alloys for eastern corporation. Five years, eastern sales manager of company manufacturing prefinished sheet metals. Seven years' experience supervising design and production of metal products. Mechanical industrial engineer graduate. Age 49. Desires new connection where supply of product is not limited. PW-592, American Machinist, 330 W. 42nd St., N. Y. 18, N. Y.

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TWO GRADUATE engineers each with 15 years' experience in metallurgy, metal processing and tool engineering in diversified industries desire to handle factory products, tools and industrial equipment as enginering and sales representatives for eastern territory with headquarters in New York. Adequate capital for inventories available. Educational background, practical achievements, references furnished upon request. RA-595, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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(Continued from pages 336 & 337)

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MONARCH 18"x10' Bed—Geared Head
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SPRINGFIELD Precision—18"x30" Centers—Timken Bearing
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AXELSON 18"x69" Centers, 24 speed—Timken Bearing
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LEHMAN 24"x18'—geared head
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AXELSON 24"x72" Centers, 24 speed—Timken Bearing
AXELSON 24"x120" Centers, 24 speed—Timken Bearing
AMERICAN 27"x96" Timken Bearing
LEBLOND 27"x96" Timken Bearing
AXELSON 32"x120" Centers, 24 speed—Timken Bearing
AMERICAN 36"x15' bed—geared head
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BRIDGEFORD 36"x32' bed—2 carriages
BRIDGEFORD 36"x44' bed—2 carriages
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AMERICAN 42"x40" bed—2 carriages
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LATHES — TURRET

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BARDONS & OLIVER #5 Univ; Timken bearing; chucking
BARDONS & OLIVER #7 Univ.; Timken bearing; chucking
WARNER & SWASEY #4A Univ. Hollow Hex.; Timken Bearing
CINCINNATI ACME #1 Universal—Timken Bearing
FOSTER #2F Univ. Fastermatic; Timken Bearing
FOSTER #3F Univ. Fastermatic; Timken Bearing
POTTER & JOHNSTON #5D Power-Flex Auto. Chucking & Turning; Timken Bearing

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MARVEL #9, 10"x10", ball bearing, Hack
PEERLESS 10"x10" Universal Hack
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CINCINNATI #3 Centerless; Filmatic
CINCINNATI #4 Centerless; Filmatic
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NORTON 6"x18" Hydraulic Surface
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CINCINNATI 16" Rapid traverse; Universal
CINCINNATI 32" Rapid traverse; Universal

MILLING MACHINES

BROWN & SHARPE #2B—Plain—Timken Bearing
BROWN & SHARPE #3A Univ.—Timken Bearing
BROWN & SHARPE #2 Vertical—Timken Bearing
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NILES 42", 2 swivel heads, power rapid traverse
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MISCELLANEOUS

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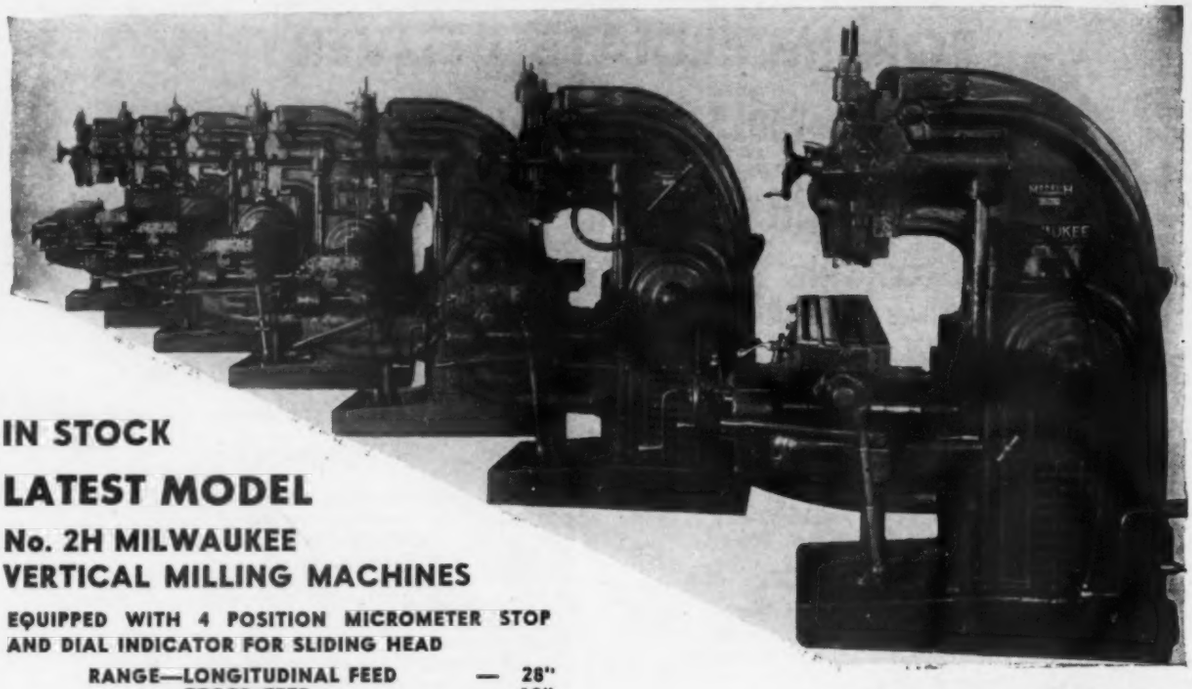

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61" Bullard Maximill 2 heads, A.C. M.D.

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36"x36' American 16 Spd. Grd. Head, 2 carriages.
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36"x18' Putnam Grd. Hd. Q.C.
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36"x16' American 16 Speed Grd. Hd. A.C. M.D.
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25"x10' LeBlond H.D. Geared Head, A.C. M.D.
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14"x6' Bradford Cone Drive, Q.C.
12"x30" LeBlond Tool Room, A.C. M.D. New 1942.

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No. 3 Cincinnati Vertical H.P.
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6" Bilgram Bevel Gear Generator.
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14" Leland & Gifford Sens.
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6' Cincinnati Bickford A.C. M.D.
7' Cincinnati Bickford.
5'13" Fosdick Pl. Radial Drill, S.P.D.

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56"x56"x36' Cincinnati, 4 Heads, A.C. M.D.
60"x48"x24' American H.D. 4 hds.
24"x24"x10' Powell Planer, 2 Heads, A.C. M.D.
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MISCELLANEOUS

No. 2A Warner & Swasey, M.D.
No. 3A Warner & Swasey, M.D.
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No. 61 1⅝" New Britain, six spindle.
16" x 33" Fay, with air chuck.

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No. 416 Baker, single spindle.
★ **21" Cincinnati-Bickford Direct Motor Driven Drill, single spindle.**
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No. 11 Natco Multiple Drill, 16 spindle.
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24" x 30' American, g.h.
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No. 1A, 2A, Warner & Swasey.
No. 4 Warner & Swasey Universal, c.d.
No. 3 Gisholt, g.h.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.
★ **42" Bullard VTL, New Era type.**

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No. 40 Universal Tri-Way Boring Mill.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3B Milwaukee Plain, m.d.
No. 4 LeBlond Plain, c.d.
No. 1A Milwaukee Plain, s.p.d.
No. 0-8 Cincinnati Plain Automatic, m.d.
18" Cincinnati Plain Mfg., s.p.d.
6" x 14", 6" x 48", P. & W. Thread Mill.
4" Pratt & Whitney Spline Mill.
42" Bullard Vertical Boring Mill.

MISCELLANEOUS
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Schraner Crankshaft Lapping Machine, Model B.
8" x 7" Troy Vertical Steam Engine.
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28" Gould & Eberhardt, s.p.d.
36" x 36" x 10' Woodward & Powell Planer, 2 heads.
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9" x 9" Peerless Hydraulic

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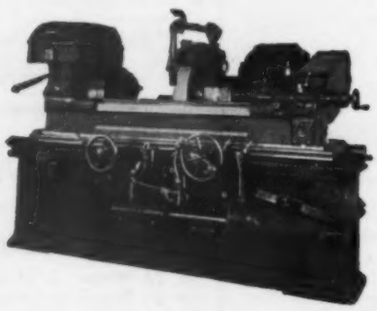

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AUTOMATICS, Cone, 1¼, 2½ & 3½" 4 spdle
CONOMATIC, 1½ & 1⅝"—8 spindle, M.D.
AUTOMATICS, Gridley, ¾, 1¼, 1¾, 2¼" & 2¾ Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" S. S.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 1¾" Model A, M.D.
AUTOMATICS, Cleveland ⅞, 1¼, & 2" Mod. B
AUTOMATICS, Cleveland 3½" 4 spdle, Mod. K4
AUTOMATICS, Potter & Johnston #5a & 6a, M.D.
DRILLS, High Speed, B. B. 1 to 6 spindles
GEAR HOBBERS, #3 & 12 Barber-Colman, M.D.
GEAR SHAPERS, #7 High Speed, M.D. & #6
GENERATOR, Gleason Spiral Bevel Gear 10"
GRINDERS, Brown & Sharpe #2 & 3 Universal
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72 Hydraulic, 2 M.D.
GRINDERS, Diamond Surface #2, M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18", M.D.
GRINDERS, Pratt & Whitney 12" Vertical Surface, M.D., 9x31", Magnetic Chuck.
LATHES, Hendey, E.B.M. type, 14"x7' & 8' M.D.
LATHES, Hendey, 16"x6' & 8' & 18"x10' M.D.
LATHES, Rockford, 18"x8' Geared Head, M.D.
LATHES, Turret, Warner & Swasey #4 G.H. M.D.
LATHES, Morey #3 G. H. Turret, M.D.
LATHES, Lo-Swing 4"x36" Seneca Falls
MILLING MACHINES, #2B Milw. & Vert. Hd.
MILLING MACHINES, Becker Vertical #5 & 6
MILLING MACHINES, Milwaukee #1B Plain & Universal #2 & 3B Plain, M.D.
MILLING MACHINES, #2B Rockford Universal
PLANER, Ohio 42"x42"x10' One Head, M.D.
PLANER-SHAPER, 30" Cincinnati M.D.
TAPPERS, Garvin #2 & 2X M.D.

OTT MACHINERY SALES, INC.
542 Second Avenue
Detroit 26, Mich.
MONA MEMBER

Cincinnati 8" x 18" Plain Grinder, M.D.
King 30", 42", and 52" Vertical Boring Mills, M.D.
MONA MEMBER
D. E. DONY MACHINERY CO
47 Laurelton Road, Rochester 9, N.Y.

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
MONA MEMBER
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

Government-Owned

SURPLUS STEEL

Reasonably priced for substitute uses

AVAILABLE NOW

Terms to fit your production budget

Over 50,000 tons of hot rolled and cold finished carbon and alloy steel bars in rounds, squares, flats and hexagons, priced downward—for substitute uses.

Budget priced, these 50,000 tons consist of 25,000 tons of carbon and 25,000 tons of alloy H.R. & C.F. bars, in sizes to meet your immediate requirements.

In addition, there are 60,000 tons of carbon and alloy billets, blooms and slabs. These semi-finished products are also priced for quick delivery in meeting the demands for substitute uses. If you qualify for credit, terms may be arranged. For detailed specifications, grades, sizes, deliveries and F.O.B. prices, simply write, wire or phone the nearest RFC Agency listed below.

WHAT ARE YOUR REQUIREMENTS? — CHECK THIS LIST

1. Carbon and Alloy Billets, Blooms, Slabs, Skelp, Rods, etc. . . . . ☐
2. Reinforcing Bars . . . . . ☐
3. Structural Steel Shapes . . . . . ☐
4. H. R. & C. R. Sheets, Strip Steel, Carbon and Alloy . . . . . ☐
5. Plates—Tin Plate, Terne Plate, Black Plate . . . . . ☐
6. Wire and Wire Products, Carbon and Alloy, Wire Rope, Reinforcing Wire Mesh . . . . . ☐
7. Stainless Steel Sheets, Strips, Standard Types . . . . . ☐
8. Iron and Steel Pipe, and Tubing—Valves and Fittings . . . . . ☐
9. Mechanical Tubing, Carbon and Alloy . . . . . ☐

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VETERANS: **To help you in purchasing surplus property from the RFC, a veterans' unit has been established in each of our Disposing Agencies.**

RECONSTRUCTION FINANCE CORPORATION

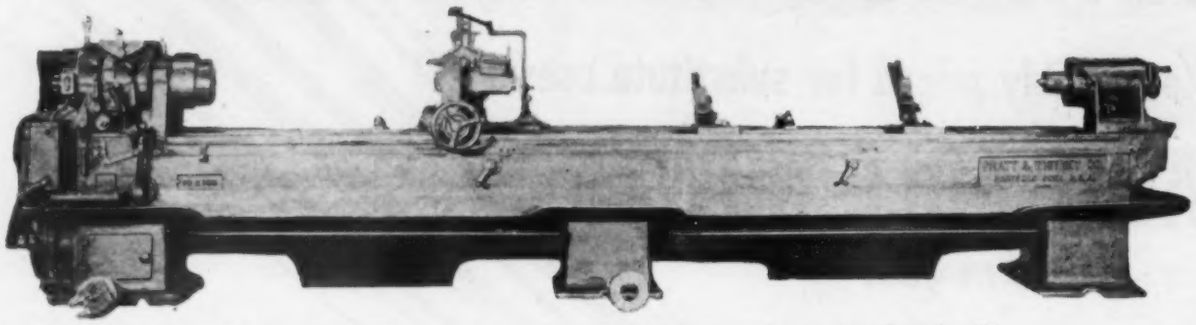
A DISPOSAL AGENCY DESIGNATED BY THE SURPLUS PROPERTY ADMINISTRATION

Agencies located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cleveland • Dallas • Denver Detroit • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville Minneapolis • Nashville • New Orleans • New York • Oklahoma City • Omaha • Philadelphia Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane

157-2

10" x 168" Pratt & Whitney THREAD MILL

IMMEDIATE DELIVERY — EXCELLENT CONDITION



Length that can be cut between centers 168"
Dia. external thread that can be milled 10"
Lead that can be cut with regular gears: minimum, threads per inch 12; maximum, lead 48"
Depth that can be cut 1-9/16"
Collet capacity 3½"
Follow rest capacity 3½"
Index ring, regular, number of notches 12
Lead screw, threads per inch 2
Speeds: work spindle speed changes (by slip gears) 17; spindle speed, min. r.p.m. 0.08; spindle speed, max. r.p.m. 1.27; cutter spindle speeds (5) 44 to 144 r.p.m. with miscellaneous collets and equipment. Arr. for motor drive with 3 H.P. A.C. motor

Wire — Write — Phone

EMERMAN MACHINERY CORP.

875 W. 120th STREET — CHICAGO 43, ILLINOIS

Special offering to the

AUTOMOBILE & AUTO PARTS INDUSTRIES

We offer for sale, for IMMEDIATE DELIVERY

For account of a prominent manufacturing Company and for our own account the below described, desirable, usable,

PRODUCTION MACHINE TOOLS

A—Two "BULLARD" Mult-au-Matics—12"—6-Spindle. These machines were bought by Buick in 1928 and transferred to present owners who had them completely overhauled in 1941, at a cost of about $10,000 and used very little after reconditioning.

The manufacturers' serial #'s are 12986 and 12991. Each machine is equipped with 15 hp motor, 3 ph, 60 cy, 440 v. The machines also include plain, combination and double purpose slides. A total of 15 tool holders for both machines.

ALSO AVAILABLE

WARNER & SWASEY #3A Universal turret lathes; Baush Turret Type Vertical Multiple Drill; Fellows High Speed Gear Shapers; Cincinnati and Kearney & Trecker Plain Millers, #3, #4, and #5.

INSPECTION INVITED — *No Red Tape*

HASCO MACHINERY COMPANY

671 FRELINGHUYSEN AVENUE, NEWARK 5, NEW JERSEY

PIPE New & Reconditioned

ALL SIZES for ALL PURPOSES
Cut and Threaded to Your Specifications
VALVES AND FITTINGS

UNITED PIPE & SUPPLY CO. Department 105 NORRISTOWN, PA.

LATEST TYPE EQUIPMENT

Cincinnati #3 Dial Type Vertical Milling machine, P F to head
Kearney and Trecker "Milwaukee" #2K Plain Horiz. Milling machine, 1942 mfg.
Porter-Cable BG-8" Belt Sander, 1942 Mfg.
Natco D-5 Multiple Drill
Blanchard #18-36" Grinder, 1942 Mfg.
Niagara #34-48"-14 Ga. Power Squaring Shear, M.D., 1942 Mfg.
Onsrud #225 Router, 1942 Mfg.
Cincinnati #2K Vertical Milling machine, Dial Type

GRINDERS

Norton Cam-mtr. dr.-late type
Marsehke 18" D. E. Ball Bearing Disc-mtr. dr., 1943
H & G Chaser-excellent condition
Sellers ¼" to 3" cap. drill grinder 1942

LATHES

Prentice Bros. 24"x18" Grd. hd-mtr. dr.
Blaisdell 24"x10' LCG-TA
Pratt and Whitney 14"x6' SQCG—TA
Monarch 14"x6' QCG
Hardinge Pre—on Bench with Equip.

TURRET LATHES

Warner and Swasey #3A SPD—chucking
Jones and Lamson 2¼x24" Steel hd—1935 Mfg.
Foster 1" geared head
Warner and Swasey #4 Mtr. Dr.—incl. drive-all-bar equipment

MISCELLANEOUS

Taylor and Fenn Cam Vertical Miller
Cincinnati 24" Duplex Miller—#50 Taper—Mtr. dr.—excellent
#2M Potter and Johnson Miller, Dual table
30"x30"x8' Gray 2-head Planer, arr: factory Mtr. dr.
36"x36"x10' Powell Planer, 1 side head, 1 rail head
#1A Gorton (Pantograph) Engraving machine
48" Apron Folder (power) 14 gauge
72" 14-gauge Dreis and Krump Apron Brake
30"x30"x10' Putnam Planer, 2 head, box bed
4' Western Radial Drill
3000# Chambersburg Board Drop Hammer

UNITED MACHINERY & TOOL CORPORATION

35 Hermon St., Worcester 8, Mass.

KEEP POSTED WITH SIMMONS

BORING MILLS

24" BULLARD New Era Vertical, one swiveling turret head, one side head.

42" BULLARD New Era vertical, one swiveling turret head, one side head.

3" Bar Universal TRI-WAY Horizontal Boring Mill with 32" x 58" table. P.R.T.

No. 1 PUTNAM Vertical Car Wheel Boring Mill, side head for hub facing and hoist. AC or DC motor drive.

72" COLBURN vertical, 2 swivel heads, all geared speeds, Power Rapid Traverse.

84" CINCINNATI Rapid Production, 1 swivel head, one turret head, Power Rapid Traverse.

100" NILES-BEMENT-POND Vertical, 2 swiveling heads, Power Rapid Traverse.

MILLERS

42" x 26" x 12' INGERSOLL Planer Miller, 4 heads, M.D.

No. 4 CINCINNATI High Power Plain, Power rapid traverse table 16½" x 64". Single pulley belt drive or AC or DC.

No. 4 CINCINNATI High Power Vertical Power rapid traverse. Table 16½" x 64". Single pulley belt drive or AC or DC motor drive.

No. 5 CINCINNATI Plain Rectangular overarm.

LATHES

20" x 20' AMERICAN Geared Head Engine Lathe.

36" x 30' LODGE AND SHIPLEY 18 speed selective geared head screw cutting engine lathe, 2 carriages. AC or DC motor drive.

42" x 36" PUTNAM Geared Head, 25' between centers. Quick change gear box.

48" x 20' NILES-BEMENT-POND Extra Heavy Geared Head, 11'5" between centers. Power cross and angular feed to compound rest. Semi-quick change gear, taper attachment.

60" x 48' N-B-P Geared Head Engine Lathe.

RADIAL DRILLS

4' AMERICAN Plain triple purpose enclosed head drill, tapping attachment.

5½' AMERICAN Full Universal Triple Geared Tapping Attachment.

6' AMERICAN Triple purpose, plain radial, motor on arm.

GEAR HOBBER

100" GOULD AND EBERHARDT Horizontal for spur, helical and worm gears. Max. capacity 101" diameter. 48" face. Forced feed lubrication.

PLANERS

36" x 36" x 12' CINCINNATI Standard Planer, 2 heads on rail, power elevation to rail, AC or DC motor drive.

120" x 96" x 20' CINCINNATI, Rapid Traverse Planer with 4 heads and 230 V. DC reversing planer motor and control.

72" x 72" x 15' N-B-P Heavy 4 heads, double deck table. 230V, DC Reversing motor drive.

16' x 10' x 30' BETTS Heavy, 2 heads on rail and 2 side heads, forced feed lubrication. 230 V DC reversing type planer, motor and control.

SLOTTERS

6" PRATT & WHITNEY Vertical Shaper with 20" rotary table, power feeds, tilting ram. AC or DC motor drive.

15" NEWTON Crank Slotter, 30" circular table, AC or DC motor drive.

MISCELLANEOUS

30' No. 3 HILLES & JONES Plate Edge Planer.

30' x ⅜" NBP Bending Rolls, pyramid type.

No. 2 PRATT & WHITNEY Jig Borer with 22" x 44" table.

ENGINEERED Machine Tool REBUILDING

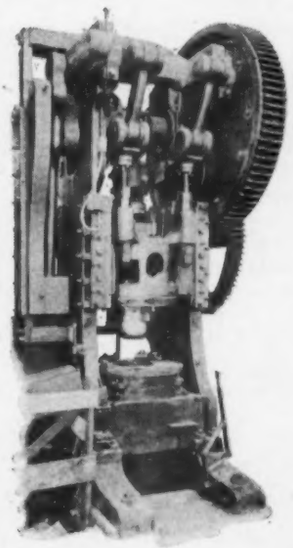
SIMMONS MACHINE TOOL CORPORATION

MAIN OFFICE & PLANT: 1759 NORTH BROADWAY, ALBANY 1, N. Y.

N. Y. OFFICE: 50 EAST 42nd STREET, NEW YORK 17, N. Y.

SIMMONS *Engineered* REBUILDING

IN STOCK



LATHES

48"x24' Blocked to 80" Fifield, D.B.G.
46"x20' b.c. Niles, 2 carriages. G.H. M.D.
36"x14' Niles, Q.C. G.H. M.D.
30"x17' Blocked to 58" Houston. Q.C. M.D.
16"x6' & 12"x6' Monarch, M.D. Late type
Many others from 7" to 98" swing. Niles, Lodge & Shipley, American, Monarch, Hendey, Leblond, South Bend, Logan, etc.

TURRET LATHES

4½" Bardons & Oliver. Bar feed. M.D.
3"x36" Jones & Lamson
#3, #4, #5, #2A, #3A Warner & Swasey
Many others from ⅝" to 6" capacity

PLANERS

60"x60"x20' Gray, 4 heads. M.D.
40"x40"x12' Cincinnati, 2 heads
30"x30"x10' Powell, 2 heads. M.D.
36"x18' Dietrich & Harvey. Open Side. 2 heads. M.D.

BORING MILLS

2½", 3½", 4", 5" Horiz. Binsee, Universal, Bausch
24" to 10' Vertical Bullard, Niles, Cincinnati, Betts, etc.

SHAPERS

7" to 32" Rhodes, Smith & Mills, Gould & Eberhardt, Stockbridge, Walcott, etc.

MILLERS

36"x36"x10' Ingersoll, planer type, 4 heads, M.D.
#2 SU Van Norman Universal, M.D.
#2, #3, #4 and #5 Universal M.D. Cincinnati, Brown & Sharpe, Milwaukee, Hendey
#2A Milwaukee, Plain. M.D.
#4 Milwaukee, Plain, M.D.
#3 Cincinnati, Plain, M.D.
#00 Cincinnati, Vertical, M.D.
#2 and #3 Brown & Sharpe, Vertical, M.D.
Brown & Sharpe and Cincinnati Production Millers, M.D.

AUTOMATICS

#00, #0, #2 Brown & Sharpe
2", 2½", 2¾" Cleveland, M.D.
Gridleys, New Britains—latest models

GRINDERS

Cylindrical, Plain and Universal, Landis, Norton, Brown & Sharpe
#2 and #5 Brown & Sharpe, Reid, Sanford, etc. Surface
#2 Cincinnati Centerless
Brown & Sharpe, Gallmeyer & Livingston, Cincinnati Universal Tool
#70 Heald Internal, M.D.
Pratt & Whitney and Springfield Vertical Surface

PUNCH, SHEARS

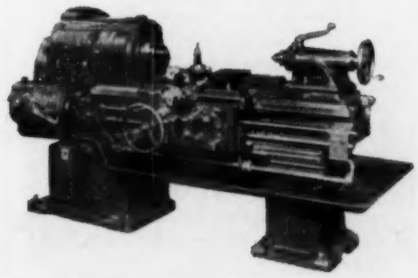
Bliss, Adlerhurst, Long & Allstatter, Excelsior, etc.

HAMMERS, PRESSES & OTHER FORGING EQUIPMENT

¼" to 8" Upsetters. Ajax, Waterbury
Hydraulic Presses, 250 to 3000 tons. Wood, Watson-Stillman, HPM, Farnham, Oil Gear Co. etc.
Mechanical Power Presses, up to 2000 tons. Ferracute, Toledo, Bliss, etc.
2000 ton HPM Turret Type Heading Press
#60½ Toledo Power Press, 1200 ton
#58 Toledo Trimming Press, 150 ton
#78½ Bliss Press
#5 Bliss Toggle Press
#6 Bliss Press, and many others
Steam Hammers from 100# to 35,000# Erie, Chambersburg, Niles, etc.
Many Waterbury-Farrell Presses

MISCELLANEOUS

New #510 Campbell Abrasive Cutter, 10"x12'
Bliss & Rafter Forming Rolls
Do-All Saws, Model V-26, M.D.
Many other special machines.



This is a partial list. Complete plants for sale or installed. Terms arranged.

S. & S. MACHINERY COMPANY

207 CENTRE STREET **NEW YORK 13, N. Y.**

EASTERN OFFERS FROM STOCK

AUTOMATICS

4 spindle ⅞" Cleveland Model M, m.d.
4 spindle 2" Cleveland Model M, m.d.
4 spindle 2¼" Cleveland Model K, m.d.
2¼" Cleveland Model A, m.d.
2⅛" Gridley Single Spindle, m.d.
2½" Cleveland Model A, m.d.
4⅛" Cleveland Model A, m.d.
5⅛" Cleveland Model A, m.d.
6" Cleveland Model A, m.d.
7⅝" Cleveland Model A, m.d.
14" Fay, m.d., Flanders Type
No. 6A Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
No. 8D Potter & Johnston, m.d.
No. 22 New Britain
No. 23 New Britain
No. 33 New Britain

BOLT THREADING MACHINES

¾" Economy Style R, with Lanco Head
3 spindle 1¼" Acme

VERTICAL BORING MILLS

24" Bullard New Era, m.d., with side head
36" Bullard New Era, m.d., with side head
42" Bullard New Era, m.d., with side head
42" Colburn, m.d., 2 heads on rail
48" Cincinnati Rapid Production, 1 turret, 1 swivel head, m.d.
52" King, m.d., 2 swivel heads
54" Bullard Spiral Drive, m.d., with side head, latest
53" Niles, m.d., 2 swivel heads
72" Colburn, m.d., 2 swivel heads
84" Niles, m.d., 2 swivel heads
54" Colburn, m.d., 2 swivel heads

HORIZONTAL BORING MILLS

Morton 60" stroke Horizontal Boring, Drill and Milling Machine and Draw Cut Traveling Head Planer, m.d.
2⅝" Bar Sargent Floor Type, m.d.
No. 0 Giddings & Lewis, m.d., 3⅛" bar
No. 21 Lucas, 2½" bar, m.d.
No. 31 Lucas, 3" bar, m.d.
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Niles, m.d.
4½" bar Niles, m.d.
5" bar Niles Floor Type, m.d.
5⅛" bar Niles-Bement-Pond Table Type, m.d.
6" bar Niles-Bement-Pond Floor Type, m.d.
10" bar Sellers Floor Type, m.d.

TURRET LATHES AND SCREW MACHINES

No. 1 Cincinnati-Acme Semi-Universal, m.d., chucking
No. 1A Warner & Swasey Universal, m.d., chucking
No. 2 Cincinnati Acme Full Universal, m.d., chucking, latest type
No. 2L Gisholt Universal, m.d., hydraulic pre-selector, chucking, latest type
No. 1L, 2L, 3L, 4L Gisholt Universal, m.d., hardened ways, Timken Bearings, chucking, very late type
No. 2 Pratt & Whitney Shaver, m.d.
No. 2B Foster Universal, m.d., chucking
No. 2 Cincinnati Acme Universal, m.d., chucking, bed extended 3', latest type
No. 2A Warner & Swasey Universal, m.d., chucking, covered ways
No. 2A Warner & Swasey Universal, m.d.
No. 3 Cincinnati Acme Full Universal, m.d., chucking
No. 3B Cincinnati Acme Fixed Center Universal, m.d., auto. chuck, latest type
No. 3, 4, 5 Warner & Swasey Universal Ram Type, m.d., Timken Bearings, latest type
No. 3A Warner & Swasey Universal, m.d., bar
No. 3A Warner & Swasey Universal, m.d., chucking
No. 3A Warner & Swasey Universal, m.d., chucking, Timken Bearings, covered always, latest type
No. 3A Warner & Swasey Universal, m.d., bar, same as above
No. 4 Gisolt, m.d.
No. 4B Cincinnati Acme, m.d., bar
No. 4 Gisholt, m.d.
No. 4 Warner & Swasey, cone
No. 4A Warner & Swasey Universal, m.d., Timken Bearings, covered ways, chucking
2½x24" Jones & Lamson Geared Head, m.d., bar
3x36" Jones & Lamson Geared Head, m.d., chucking
3x36" Jones & Lamson Geared Head, m.d., bar
2 spindle 3x36" Jones & Lamson Geared Head, m.d., chucking
3¼" Cincinnati Acme Geared Head Flat Turret, 3½x32" Jones & Lamson Geared Head, m.d., chucking
3½x32" Jones & Lamson Geared Head, m.d., bar m.d.
18" Libby Type A, m.d., chucking
20" Acme, cone
20"x7" American Turret, cone
24" Gisholt, cone
24" Steinle, m.d.

More than 1200 machines in stock for prompt shipment. Send us your inquiries.

The
EASTERN
MACHINERY CO
1004 TENNESSEE AVE
CINCINNATI 29, OHIO

IN STOCK

BORING MILLS

61" Bullard Maximill
54" & 42" Bullard V.T.L.
3½" bar Lucas horizontal
3½" & 2" Universal horizontal

DRILLS

4' Carlton radial
4' Hammond radial
34 spdl. No. 30 Natco multiple
20 spdl. No. 4 Baush multiple, 2" spdl. No. 3 taper, hydraulic feed
24", No. 25 Foote Burt heavy
21" & 24" Cincinnati upright

GEAR CUTTERS

Nos. 3 & 12 Barber Colman hobbers
Nos. 16HS & 18H Gould & Eberhardt
Nos. 7 & 61 Fellows shapers
Nos. 1 & 5A Lees Bradner hobbers
11" Gleason bevel generator
18" Gleason testers & lappers
No. 3 Barber Colman hob grinder

GRINDERS

36", No. 18 Blanchard surface
16", No. 10 Blanchard surface
18" Arter rotary surface
14" Pratt & Whitney vert. surface
6"x18" Norton hydr. surface
6"x18", No. 2 B. & S. surface
No. 2 Brown & Sharpe universal
No. 1½ Cincinnati tool & Cutter
No. 104 Rivett internal
No. 72A3 Heald Sizematic internal
53" & 72" Gardner horizontal disc
20", No. 120A Gardner opposed disc
No. 2 Cincinnati centerless

HAMMERS

150 lb. Bradley upright helve
No. 2B Nazel pneumatic
2000 lb. Chambersburg board drop
2000 lb. & 3000 lb. Billings & Spencer board drop

LATHES

60"x37'9" Niles-Bement-Pond geared head
60"x75'6" N-B-P double end
36"x16'6" Bridgeford geared head
14"x6', 16"x8' & 16"x10' Hendey
17"x6' Leblond grd. hd. Mfg.
14"x18" Monarch Magnamatic
14"x19" Fay automatic
15"x22½" Sundstrand auto. stub.
8" & 12" Sundstrand stub.

MILLERS

Nos. 2B & 3B Milwaukee Plain
No. 35 Ohio universal
No. 2 Cincinnati dial type vertical
No. 2 Brown & Sharpe vertical
No. 2½B Milwaukee vertical
No. 4—36 Cincinnati Hydromatic
No. 3 Sundstrand Rigidmil
30" x 48" Newton rotary

SHAPERS & PLANERS

6" Pratt & Whitney vertical shaper
7" Rhodes shaper
16" Ohio shaper
16" & 24" G. & E. shapers
36" Morton draw cut shaper
24"x24"x6' Gray planer
48"x48"x16' D. & H. openside planer

SEND FOR COMPLETE LIST

MILES MACHINERY CO.
SAGINAW, MICH.

CLOSEOUTS

BORING MILLS

HORIZONTAL

2½", 4" Binsee

VERTICAL

66", 120" Niles
54" Colburn, M.D., 2 hds.

TURRET LATHES

Foster Nos. 4, 5, 6, 1B, 3B M.D. Univ.
J. & L. 2¼"x24", 3¼x30".
Acme 3¼" M.D.
No. 1L Gisholt Univ. M.D.

GRINDERS

P. & W. 14", 18", B.B., Vert. M.D.
Blanchard 30", M.D.; Modern 12x48", M.D.
Norton Hydraulic 12x18", M.D.
Heald Nos. 72A3 Gagematic
Norton 50"x28', M.D.
Landis Type A 6x20" Hydraulic, M.D.
Bryant No. 12, M.D.
Nos. 50, 55, 60 Heald Int. Hydraulic, M.D.
12" Heald Rotary, Arter 12" M.D.
B. & S. No. 2 Surface, M.D.
Norton 10x36" Hydraulic, M.D.
B. & S. No. 10 1' Cyl.
No. 2 Cincinnati Centerless, M.D.
B. & S. No. 1, 3 Universal
#25, #35 G. & L. M.D.

LATHES

McCabe 26-42"x14'
26x12' Boye & Emmes 3 step cone, B.D.G.
20"x14' Rahn-Larmon, raised to 24"
14"x6', 16"x6' Hendey
9" LeBlond Automatic
36x30' Putnam, M.D.
36x22" Putnam S.C.G., D.C.M.D.
32"x36' Wickes
Putnam 42x16', M.D.
30x26' L. & S. 12 speed M.D.
P. & W. 1x18, 1¼x18 Automatic Lathes

AUTOMATICS

B. & S. No. 2, Hand Screw
B. & S. No. 00, 0, 2, 00G
5 Spdle. Davenport 9/16" cap.
Cleveland Model A ½", ⅝", 1¼", 2"
Cleveland Model B 1", 2"
P & J. 6A, M.D.
⅞" Cone 4 spindle

New In Stock

5, 10, 18 ton OBI Power Presses
7" Ammco Shapers
Halco H.S. Vertical Milling Heads, Drill Presses

RADIALS

4', 5', 6' American Triple Purpose
4', 5' Cincinnati-Bickford
4' Mueller, M.D.; 4', 5' Western, S.P.D.

MILLING MACHINES

Gorton 8D Vertical, M.D., 9J
Cincinnati, #2 Univ.
No. 3S Cincinnati, S.P.D. rapid trav. M.D.
Nos. 1Y, 0Y, 3, 4, 5 B & S Plain & Univ.
B. & S. Nos. 12, 13, 13B
Hall Planetary Model D Thread Miller
Providence Planer Type 32"x8'
Becker Nos. 3, AB, 5, 6 Vert.
Nos. 3, 4, Cincinnati Vert.
P. & W. No. 12, 30 Profiler, M.D.
No. 4 B. & S. Universal
K. & T., B. & S. No. 2, 3 like new
B. & S. No. 2, 3, Vert.
Kempsmith No. 1 Univ.

MISCELLANEOUS

Gorton No. 1S Engraving Machine, 3U
6 spindle Avey Drill, 15" overhang
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6" Vert. Shaper, P. & W.
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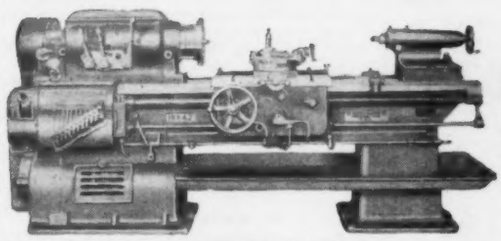

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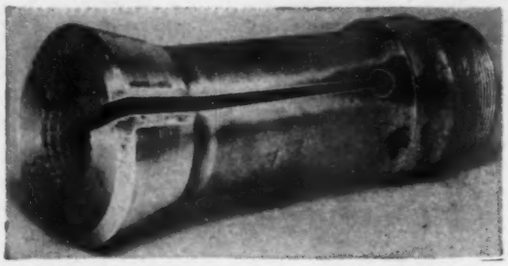

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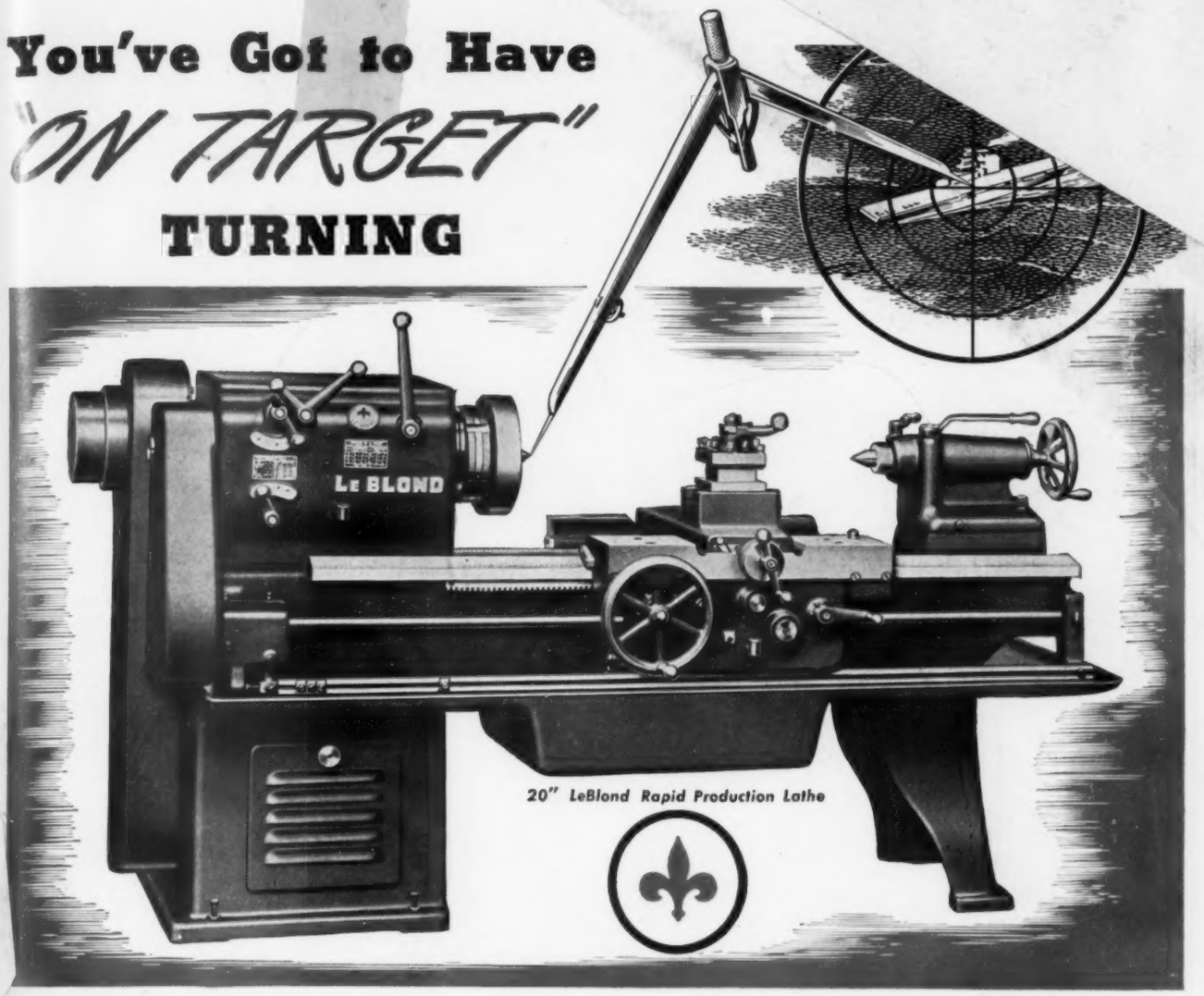

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